FIRST SEMESTER

CHI HCT: 1.1. CONCEPT AND MODELS OF INORGANIC CHEMISTRY

Objectives

- To study the structures of ionic crystals and simple molecules through VSEPR model.
- To learn acid-base concepts and chemical reactions in non-aqueous, ionic liquids and supercritical fluids as media.
- To study the chemistry of f-block elements.

Course Outcome

- The periodic properties of the elements, structures of ionic solids and their lattice energy calculations. Further, the use of VSEPR concepts in analyzing the structures of simple molecules.
- Various acid-base concepts and their applications in different fields. Also, understand the utility of various non-aqueous solvents in inorganic synthesis.
- Complete understanding of the chemistry of lanthanides, actinides and their applications.

Pedagogy

- Familiarize the students with the periodic properties of the elements using modern periodic table.
- Teaching through conventional method such as black board and chalk, and modern methods like power point presentation.
- For teaching structures of solids, crystal models (MX and MX_2 types) are used.

CHO HCT: 1.2. STEREOCHEMISTRY AND REACTION MECHANISM

Objectives

- To understand detailed molecular structures of organic compounds.
- To learn bonding and chemical reactions of organic compounds.
- To study different chemical reactions involved in organic synthesis.

Course Outcome

- Optical and geometrical isomerism of Organic compounds. Application of stereochemistry in the study of regioselective and regiospecific reactions.
- The study of HMOT and its applications to simple organic molecules, and also understand the concept of aromaticity and methods of determining reaction mechanism.
- Nucleophilic, electrophilic and elimination reactions.

Pedagogy

- Molecular models are used to teach stereochemistry.
- Teaching through conventional method such as black board and chalk, and modern methods like power point presentation.

CHP HCT: 1.3. BASIC PHYSICAL CHEMISTRY

Objectives

- To understand thermal properties of chemical compounds.
- To study the rate of chemical reactions including fast reactions and factors influencing the reaction rate.
- To understand the theory of electrochemistry in solution.

Course Outcome

- The completion of this course will enable the students to gain the knowledge on fundamentals and theoretical background on the concepts of chemical thermodynamics, chemical kinetics and electrochemistry of solutions.
- This helps in understanding the stability and energetics of reaction.

Pedagogy

- Teaching through conventional method such as black board and chalk, and modern methods like power point presentation.
- To teach electrochemical aspects through animations.

1.4. FUNDAMENTALS OF ANALYTICAL CHEMISTRY

Objectives

- To familiarize statistical methods to validate analytical methods.
- To learn sampling techniques and conventional volumetric methods.
- To learn extraction and chromatographic methods for the separation and identification of different compounds.

Course outcome

- To enhance the knowledge on usage of analytical terminologies
- To build the skills on statistical analysis and comparison of results
- To aquire the skills on sampling, purification, separation and data analysis using instrumental techniques.
- To excel the knowledge on various separation techniques
- Explore topics such as experimental design, sampling, calibration strategies, standardization, optimization, statistics and the validation of experimental results

Pedagogy

- Teaching through conventional method such as black board and chalk, and modern methods like power point presentation.

To evaluate validation parameters, MS-Office tools *viz.,* MS-Excel sheets can be used

CHA SCP: 1.1/2.1. ANALYTICAL CHEMISTRY PRACTICALS-1

[128 HOURS].

Course Objective

- To understand basic concepts by carrying out analytical experiments.
- The experimental results are subjected to validation of analytical parameters

Course Outcomes

After studying this course the student to:

- Analyze various samples with different classical and simple instrumental skills.
- Obtain knowledge for selection of analytical methods with suitable technique being adopted for the analysis different samples like, water, laboratory chemicals and reagents, body fluids such as urine etc.
- Distinguish classical and instrumental methods.
- Propose and conduct experiment for quantification of individual analytes

CHO SCP: 1.3/2.3. ORGANIC CHEMISTRY PRACTICALS-1

Objectives

- To understand synthetic methods by carrying out different experiments.
- To develop the skill for the separation and qualitative analysis of binary mixtures of organic compounds.

Course Outcome

- Students are involved in the multi-step synthesis of different organic compounds.
- Understand the qualitative analysis of binary mixture of organic compounds through separation, identification of functional groups and preparation of solid derivatives.

Pedagogy

- Each student performs experiments as per the protocol in practical classes. Experimental setup for the synthesis of organic compounds by every individual.

CHP SCP: 1.4/2.4. PHYSICAL CHEMISTRY PRACTICALS -1

Objectives

- To understand the rate of chemical reactions and factors influencing the reaction rate by carrying out kinetic experiments.
- To understand basic concepts of electrochemistry by carrying out experiments.

Course Outcome

- After the completion of this course, the students can able to develop the experimental skill and theoretical interpretation of experimental results of many physical chemistry experiments of chemical kinetics in solution phase, thermodynamics, electrochemistry and spectrophotometry.
- This helps in academics, research and industries.

Pedagogy

- Each student performs experiments as per the protocol in practical classes.
- To optimize the reaction conditions for understanding the rate of chemical reactions.

SECOND SEMESTER

CHI HCT: 2.1. COORDINATION CHEMISTRY

Objectives

- To understand the preparation, properties, electronic configuration and structural elucidation of coordination compounds.
- To learn the reaction mechanism, stereochemistry and photochemistry of coordination compounds.

Course Outcome

- Gain the knowledge of preparative methods of coordination compounds and geometries of different coordination numbers.
- Understand the CFT and MOT bonding theories of metal complexes.
- Electronic spectra, magnetic properties and infrared spectroscopy of coordination compounds. In addition, understand the reaction mechanism and photochemistry of coordination compounds.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

CHO HCT: 2.2. SYNTHETIC ORGANIC CHEMISTRY

Objectives

- To understand the reactions of organic compounds involving various reagents.
- To learn the synthesis and retro-synthesis of different organic compounds.

Course outcome

- Students are familiar about chemistry of oxidants, reductants and their applications in the organic synthesis.
- Understand the various catalysts in organic synthesis by known naming reactions.
- Retro-synthesis and molecular rearrangement.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern method like power point presentation is used in class room teaching.

CHP HCT:2.3. PRINCIPLES OF PHYSICAL CHEMISTRY

Objectives

- To understand the theoretical calculations of energies of simple molecules.
- To learn the calculation of different energies by statistical

thermodynamics.

- To understand the basics of polymers, their kinetics and applications.

Course Outcome

- Principles of Quantum chemistry and theoretical calculations of energies of molecules and chemical reactions.
- Apply solutions of the Schrödinger equation for simple systems (particle in a box, rigid rotor, harmonic oscillator) to real systems (vibrational, rotational, and electronic energy states) in determining the energy of stationary states.
- Explain angular momentum as possessed by atomic or molecular systems, various descriptions of how angular momentum can be coupled, and how conservation of angular momentum is important to spectroscopy.
- Concepts and applicability of statistical thermodynamics in the calculations of different energies in the reacting system. Applications of phase rule for separation of the metals from ore.
- Fundamentals of polymers and their applications in controlling the quality and waste management of polymer product.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern method like power point presentation is used in class room teaching.
- Assigning the students to solve the problems to understand the concepts.

2.4. MOLECULAR SYMMETRY AND SPECTROSCOPY

Objectives

- To understand the concepts of symmetry and symmetry operations and their application to CFT, hybridization, MOT and vibrational spectroscopy.
- To learn the theory and applications of microwave, vibration and Raman spectroscopy.
- To understand the principles and applications of UV-Visible and resonance Raman spectroscopy.

Course outcome

- Molecular symmetry and applications of group theory to CFT, hybridization, MOT and vibrational spectroscopy.
- Theory and principles of Rotation, Vibration and Raman Spectroscopy.
- Theory and principles Electronic and Resonance Raman spectroscopy.

Pedagogy

- Conventional method such as black board and chalk is used.

- Molecular models are used to teach symmetry aspects of molecules
- Modern methods like power point presentation and animations are used in class room teaching.
- Students will be assigned to solve the numerical problems.

THIRD SEMESTER

CHI HCT: 3.1. ADVANCED INORGANIC CHEMISTRY

Objectives

- To understand the fundamental concepts of organometallic chemistry and general principles of homogeneous and heterogeneous catalysis.
- To learn the concepts of metal clusters, silicates and silicones.

Course Outcome

- Fundamental concepts of organometallic chemistry and synthesis, structure and bonding in different organometallics and their applications.
- Homogeneous and heterogeneous catalysts and their applications in the synthesis of organic compounds in industries.
- Chemistry of main group elements, metal clusters, silicates and silicones and their applications in day to day life.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

CHO HCT: 3.2. ORGANOMETALLIC AND PHOTOCHEMISTRY

Objectives

- To understand the fundamental concepts of photochemistry and pericyclic reactions.
- To learn the synthesis and reactions of organometallic compounds.
- To learn the asymmetric synthesis of organic compounds.

Course Outcome

- Basic concepts of photochemistry and pericyclic reactions and their usefulness in the synthesis of many organic compounds.
- Synthesis of organic compounds using different organometallic compounds as catalysts.
- Asymmetric synthesis of organic compounds using chiral compounds.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation is used in class room teaching.

CHP HCT: 3.3. ADVANCED PHYSICAL CHEMISTRY

Objectives

- To understand the concepts of enzyme kinetics, industrial catalysis and linear free energy relationship.
- To learn the electrochemical aspects of batteries and electroplating.
- To understand the mechanism of corrosion prevention of metals by different methods.
- To understand the fundamentals of X-ray crystallography.

Course Outcome

- Applications of reaction kinetics help in correlating the rates of biological and chemical reactions.
- Theory and applications of electrochemical systems helps in the field of e-waste management and protection of metals.
- Fundamentals of X-ray crystallography and structural interpretation by various X-ray diffraction techniques.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animation are used in class room teaching.
  Students will be assigned to solve the numerical problems to understand the concepts

CHG HCT: 3.4. CHEMICAL SPECTROSCOPY

Objectives

- To understand the basic concepts of spectroscopic techniques such as NMR, ESR, NQR, Mossbauer and photoelectron spectroscopy.
- To familiarize with the IR and mass spectroscopy.

Course Outcome

- Understand the spectroscopic techniques such as NMR, IR, UV, and MS for recording and interpretation of spectra.
- Understand the characterization of chemical compounds.
- To learn electric and magnetic properties of radiation, molecules and bulk matter and solve the problems related to these properties.

- Understanding various fragmentation reactions of organic molecules.
- Predict the NMR, IR, UV, and MS spectra from a given molecular structure, including fragment-ions in MS.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animation are used in class room teaching.
- Students will be assigned to solve the spectroscopic problems to understand the interpretation of spectra.

CHA SCP: 3.1/4.1. ANALYTICAL CHEMISTRY PRACTICALS-II

[64 HOURS]

Objectives

- To familiarize with the handling of instruments in the quantitative analysis of various samples.
- To understand the analysis of real samples like waste water, soil samples and biological samples and mixtures

Course Outcomes

After studying this course, the student to:

- Get experience on analysis of various complex mixtures by following multistep reactions.
- Acquire the knowledge on handling instruments and to overcome the general problems arises during the analysis.
- Acquire industrial skills required for sampling, analytical and interpretation and presentation of results.
- Possess adequate knowledge on literature search for developed analytical methods.

Pedagogy

- Each student performs experiments as per the protocol in practical classes.

Computer aided applications are used for the evaluation of experimental results

CHI SCP:3.2/4.2. INORGANIC CHEMISTRY PRACTICALS-II

[64 HOURS]

Objectives

- To familiarize with the instrumental methods of analysis for determining metals present in the different samples.

- To familiarize with the preparation and characterization of different inorganic complexes.

Course Outcome

- Determination of alloy samples and understanding the electrochemical deposition of metals.
- Preparation and characterization of coordination compounds.
- Determination of composition, stability constant and magnetic susceptibility of metal complexes.

Pedagogy

- Each student performs experiments as per the protocol in practical classes.
- Spectroscopic tools are applied for the characterization of the synthesized complexes.

CHO SCP: 3.3/4.3. ORGANIC CHEMISTRY PRACTICALS-II

[64 HOURS]

Objectives

- To understand the concepts of isolation and purification of natural products.
- To familiarize with the estimation of different functional groups in organic compounds.

Course Outcome

- The isolation of caffeine, carotene, lycopene, cincole, azelaic acid and piperine from respective natural sources.
- Estimation of ketones, sugars, nitro and amino groups in natural products.
- Interpret UV, IR, NMR and MS data of different organic compounds.

Pedagogy

- Each student performs experiments as per the protocol in practical classes. Spectroscopic tools are applied for the characterization of isolated natural products

CHP SCP: 3.4/4.4. PHYSICAL CHEMISTRY PRACTICALS

Objectives

[64 HOURS]

- To understand the significance of various factors influencing the reaction rate in proposing the reaction mechanism.
- To understand electrochemical and spectrophotometric methods of quantification of samples, and also determination of physico-chemical parameters of some important samples.

Course Outcome

- Students can able to develop experimental skill and interpretation of plausible mechanisms of reactions.
- Gain practical knowledge on the theoretical basis of

electrochemistry, thermodynamics, and spectrophotometry experiments.

- This helps in academics, research and industries.

Pedagogy

- Each student performs experiments as per the protocol in practical classes. Electrochemical and spectrophotometric tools are used to conduct the experiments

FOURTH SEMESTER

CHI HCT: 4.1. BIOINORGANIC CHEMISTRY

Objectives

- To understand the structural parameters of metallo-proteins and their biological role.
- To learn the biological properties of metal complexes in chemo and radio therapeutics.

Course Outcome

- Structural building blocks of proteins, nucleic acids and their metal ion interactions. Biological role of Na/K channel, Ca, Vit B12, and coenzymes.
- Biochemical reactions of several metallo-enzymes and oxygen transport proteins.
- Medicinal applications of metals and metal complexes, and also treatment of toxicity due to heavy metal ions.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

CHO HCT: 4.2. HETEROCYCLIC AND BIOORGANIC CHEMISTRY

Objectives

- To familiarize with the chemistry of heterocyclic compounds.
- To learn the synthesis and biological importance of carbohydrates, proteins and nucleic acid.

Course Outcome

- Structure, reactivity and synthesis of several heterocyclic compounds.
- Synthesis, industrial and biological importance of carbohydrates.
- General synthesis of amino acids, peptides, nucleic acids and their biological significance.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

CHP HCT: 4.3. NUCLEAR, RADIATION AND PHOTOCHEMISTRY

Objectives

- To understand the theory and applications of photochemistry.
- To learn the fundamentals and physico-chemical applications of radiation chemistry.
- To familiarize with the concepts of nuclear chemistry including radiochemical separation techniques and nuclear power reactors.

Course Outcome

- Understand the principles of photochemistry, its experimental techniques and applications.
- Fundamentals of radiation chemistry, experimental methods of detection of radiation and applications of radioisotopes.
- General aspects of nuclear chemistry, different types of nuclear reactions, production and separation of radioisotopes and also basic features of different types of nuclear reactors.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.

CHA HCT: 4.4. INSTRUMENTAL METHODS OF ANALYSIS

Objectives

- To understand the theory, instrumentation and applications of atomic emission spectroscopy.
- To get excel the knowledge on electro analytical techniques
- To learn the principles, instrumentation and applications of thermal methods of analysis.

Course Outcomes

After studying this course, the student to:

- Gain the knowledge on the differences between classical and instrumental methods of chemical analysis.
- Explain different types of instrumental methods employed in chemical analysis.
- Develop an understanding of the range and theories of instrumental methods available in analytical chemistry.

- Make clear distinctions among spectrometric, electro-analytical, thermal and
  microscopic methods.
- Gain knowledge pertaining to the appropriate instrumental techniques.
- Obtain the practical experience in selected instrumental methods of analysis.
- Develop the skills on instrumental methods for planning, developing, conducting,
  reviewing, conducting experiments and reporting results.

Pedagogy

- Conventional method such as black board and chalk is used.
- Modern methods like power point presentation and animations are used in class room teaching.
- Students will be assigned numerical problems to understand the concepts.