Programme: M.Sc. CHEMISTRY

PROGRAMME OUTCOMES

PO1: On successful completion of M.Sc. Chemistry programme, students will have the ability to:

- Gains complete knowledge about all fundamental aspects of all the branches of chemistry.
- Think critically and analyze chemical problems.
- Present scientific and industrial information resulting from laboratory experimentation in both written and oral formats.

PO2:

- Worldwide level research opportunities to pursue Ph.D. programme
- Targeted approach of CSIR –NET, GATE examinations.
- Vast job opportunities at all level of chemical, pharmaceutical, food products, polymer, health and life sciences-oriented industries.

PO3:

- Specific placements in R & D and synthetic division of polymer & material industries.
- Discipline specific competitive exams conducted by public service commission.
- Opportunities to get jobs in central and state government organizations.

COURSE OUTCOMES

SEMESTER I

Inorganic Chemistry – I

- To make them understand about chemical bonds and theories involved, stable molecule formation, crystal structure, important inorganic materials with wide applicability, various solvent systems, instrumental methods to explain the properties of compounds, metal carbonyls and metal clusters and nuclear chemistry.

Organic Chemistry-I

- Understand the nature of bonding in organic molecules.
- Realize the terms aromaticity, anti-aromaticity, homoaromaticity in different organic molecules.
- Know about the various reactive intermediates, mechanisms in organic synthesis.
- Understand the concept of stereochemistry.
- Know about the structure and reactions of carbohydrates and heterocyclic compounds.

Analytical Chemistry-I

The student will be able to;

- The significance of calibration and lab safety.
- Differentiate acid-base, redox, precipitation, Karl-Fischer, non-aqueous titrations.
- To gain knowledge about gravimetric and kinetic methods of analysis.
- Understand the concepts of indicator electrodes.

Physical Chemistry-I

- Able to understand the origin of quantum mechanics and identify the phenomena responsible for failure of classical mechanics
- Able to appreciate the application of perturbation theory and variation method for studying complex chemical systems
- Capable of writing and solving the Schrödinger equation for complex systems using quantum mechanical concepts.

- Capable of deriving the rate constant on the basis of collision theory, assumptions and principles of Transition State Theory
- Understands and learns the skills used in various types of Flow Systems, different techniques for the study of kinetics of fast reactions.

Mathematics For Chemists

- Basic concepts of vectors, algebra, calculus.
- Problems involving elementary differential equations.

Practical: **Inorganic Chemistry – I**

- To impart the student thorough knowledge of systematic qualitative analysis of mixtures containing two anions and three cations with interfering ion by Semi micro qualitative method.

Practical: **Organic Chemistry – 1**

- Predict and analysis of the major and minor products.
- Calculation of percentage yield of the chemical reactions.

Practical: **Analytical Chemistry – I**

- Handling conductometer and potentiometer for the determination of various parameters.

Practical: **Physical Chemistry – I**

- Determine the rate constant theoretically and graphically for the hydrolysis and saponification of esters
- Able to verify Beer's Law and estimate the concentration of Cu^{2+} and Fe^{2+} ions by colorimetric method and also evaluate the molar extinction coefficient.
- Able to estimate of Fe^{2+} ions in a given solution by titrating FAS versus KMnO4 solution using colorimetric method.

SEMESTER II

Inorganic Chemistry – II

- To develop ability in the students to understand the formation of stable complexes, their instability and their applicability in day-to-day life.
- To make them understand about various theories such as CFT, LFT, MOT, Orgel and T-S diagrams to know the formation of complexes.
- To interpret the electronic spectra of complexes and understand their magnetic properties.

Organic Chemistry – II

- Attain the skills for the stereochemical assignment and interpretation.
- Formulate mechanistic study of organic reactions and synthesis.
- Basic concepts, classification and biological significance of amino acids and peptides.
- Rearrangement reaction in organic chemistry.

Physical Chemistry – II

- To understand the concepts of classical, statistical and non-equilibrium thermodynamics.
- To acquire an in-depth knowledge of all the theories of electrochemistry.

Spectroscopy – I

- Understand the basics of group theory and symmetry and its application to quantum mechanics.
- The student will be able to understand: (a) The electronic structure of diatomic molecules (b) Molecular term symbols (c) Selection rules for electronic transitions.
- The student will be able to understand: EPR, Microwave, IR and Raman spectroscopy.

Research Methodology: At the end of the course, the students will be able to

- Identify the overall process of designing a research study from its inception to its report.
- Select and define appropriate research problem, organize and conduct research in a structured manner.
- Prepare a project proposal, to write a research report, articles and thesis in a decipherable manner.

Practical: **Inorganic Chemistry – II**

- Preparation of Complexes to make the students to understand the various requirements for coordination complex preparation and analysis.

Practical: **Organic Chemistry - II**

After completion of these course students should be able to;

- Understand the concept of Qualitative analysis involving bifunctional groups.
- Develop skills to understand the reactions of different functional groups by hands on experience.

Practical: **Physical Chemistry – II**

- The student must be able study the hydrolysis at two different temperature and concentration and report the relative strength and energy of activation.
- Able to evaluate the Arrhenius parameter for the reaction between $K_2S_2O_8$ versus KI (first order).
- Able to determine the dissociation constant of a given indicator by colorimetric method.

Practical: **Analytical Chemistry – II**

- Handling conductometer and potentiometer for the determination of various parameters.

SEMESTER III

Inorganic Chemistry – III

- The topic gives wide exposure to the mechanism of substitution reactions in coordination compounds.
- Study of outer sphere and inner sphere mechanisms in the formation of complexes
- Predict the mechanisms of different biomolecules including hemoglobin, myoglobin, ferritin, transferritin and siderophores.
- Study of different role of Metalloenzymes.

Physical Chemistry – III

- Detailed knowledge of solid state involving electronic, electrical properties, crystal defects, heat capacity, super conductivity, phase transitions, symmetry and X-ray diffraction.

Organic Chemistry – III: After completion of these course students should be able to;

- Understand the concept of aliphatic nucleophillic and electrophillic reactions, free radicals and natural products.
- Understand the concept of pericyclic reactions.
- Able to know different types of oxidizing and reducing agents and their application in different types of name reactions and laboratory scale.

Spectroscopy – II: The student will be able to:

- Learn the working principle and instrumentation of UV-Vis, IR, NMR, Mass and Mossbauer spectroscopy.
- Analysis of organic molecules by different spectroscopic techniques.

Practical: **Inorganic Chemistry – III**

- Gravimetric analysis to give training in the quantitative analysis of metal ions using gravimetric method.

Practical: **Physical Chemistry - III**

- To understand the kinetics of oxidation, hydrolysis, decomposition and autocatalytic reactions.

***Practical*: Organic Chemistry – III**

- Enable students to perform the estimations, two-stage preparations, reaction monitoring and product yield calculation.

Practical: **Inorganic Chemistry IV**

- Volumetric analysis to develop skills for quantitative estimation using different methods of analysis.

Forensic Science (Open Elective)

At the end of the course the student will be able to know

- The history of the forensic sciences and the roles of different types of professionals involved in evaluating a crime scene and the collected evidence
- The methodology of collecting & interpreting data, avoiding contamination, and preservation of chain of custody how to present evidence in a professional (courtroom) setting

SEMESTER IV

Inorganic Chemistry – IV

- Structure, synthesis, bonding and reactivity of different organo-transition metal complexes including ring slippage and cyclometallation reaction.
- Study of fluxionality and dynamic equilibrium in organometallic complexes.
- An exhaustive study on isoelectronic and isolobal analogy including catalytic studies.
- Predict the mechanisms and illustrate the difference in reactivity of various industrial catalytic processes with special reference to polymerization reactions of inorganic polymers.

Organic Chemistry – IV

After completion of this course students should be able to;

- Understand the concept of aromatic nucleophilic and electrophilic substitution reactions.
- Able to know the chemical correlation of assigning the configuration, rules and methods of ORD and CD, describe ring synthesis via retrosynthetic approach, protective groups in organic synthesis; special emphasis on protection and deprotection of hydroxyl-, carbonyl-, carboxylic acid and amines.

Analytical Chemistry – III

The students will acquire knowledge

- To explain basic principles of atomic absorption spectroscopy
- To differentiate various types of thermal methods of analysis
- To compare atomic emission and atomic absorption spectroscopy.
- To use different electroanalytical techniques.

Practical: Organic Chemistry – IV

- Able to estimate the amount of unknown compounds quantitatively.
- Expertise them to prepare different standard solutions.
- To make the students to analyse the exact concentrations of solutions.

Project / Viva Voce

Completing a project enable students to –

- Understand the methodology of research/ principles and techniques.
- Develop skill in conducting research from planning to report writing.
- Find at least one solution to a real problem.

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