Class:- M.Sc. I and II
POs, PSOs / PEOs:-

Program Educational Objectives (PEOs):-

PEO-1: To develop a strong foundation in fundamental and advanced concepts of chemistry, enabling students to apply scientific principles effectively in research, industry, and academia.
PEO-2: To equip students with practical laboratory skills and expertise in modern analytical, synthetic, and computational techniques for solving complex chemical problems.
PEO-3: To foster critical thinking, problem-solving abilities, and independent research skills to contribute to innovations in chemical sciences and interdisciplinary fields.
PEO-4: To prepare graduates for successful careers in chemical industries, research institutions, higher education, and entrepreneurship by promoting ethical practices and lifelong learning.

Program Outcomes (POs): Students will be able to-

PO-1: Demonstrate comprehensive knowledge of core chemistry subjects including physical, organic, inorganic, and analytical chemistry.
PO-2: Apply theoretical concepts and practical techniques to design and conduct experiments, analyze data, and interpret results effectively.
PO-3: Utilize modern instrumentation and computational tools for chemical analysis, synthesis, and characterization.
PO-4: Understand the societal, environmental, and safety aspects related to chemical research and industrial practices.

Program Specific Outcomes (PSOs): Students will be able to-

PSO-1: Apply the chemistry knowledge to provide solutions to the contemporary societal problems in fields of materials science, environmental science, and pharmaceutical chemistry.
PSO-2: Interpret the properties of various chemicals using the analytical techniques learned and relate the chemical characteristics to functioning and performance of various functional materials.
PSO-3: Assess and evaluate facts, claims and arguments using their scientific knowledge.
PSO-4: Define a problem, analyze, interpret and draw conclusion by planning, implementing and reporting the results of an experiment.

M.Sc. Part – I (Semester – I)
Paper I-CHT101: Inorganic Chemistry-I [Credit 4, 60 Hrs.]

COURSE OUTCOMES (COs): Students will be able to-

CO-1: Learn the properties, bonding theories, and stereochemistry of transition metal complexes using Crystal Field Theory and Molecular Orbital Theory.
CO-2: Apply concepts of molecular symmetry and group theory to analyze and classify molecular structures and their spectroscopic properties.
CO-3: Study the synthesis, bonding, and catalytic applications of organometallic compounds and interpret their reaction mechanisms.
CO-4: Evaluate chemical and instrumental analytical methods, including chromatographic techniques, and apply statistical tools for data accuracy and error minimization.

Paper II-CHT102: Organic Chemistry-I [Credit 4, 60 Hrs.]

COURSE OUTCOMES (COs): Students will be able to-

CO-1: Analyze the structure and reactivity of compounds and also understand different aliphatic nucleophilic substitution reaction
CO-2: Realize the terms aromaticity, anti-aromaticity, homoaromaticity in different organic molecules.
CO-3: Know about the types of reactions and mechanisms by realizing the various factors which are affecting on the reactions.
CO-4: Apply the concept of stereochemistry by writing the different projection formulae.

Paper-III, CHT103: Physical Chemistry-I [Credit 4, 60 Hours]
COURSE OUTCOMES (COs): Students will be able to-

CO-1: Apply thermodynamic principles to analyze entropy, chemical potential, and phase equilibria in ideal and non-ideal solutions.
CO-2: Utilize statistical thermodynamics to relate molecular partition functions to macroscopic thermodynamic properties and equilibrium constants.
CO-3: Explain surface phenomena including adsorption, micellization, and their applications in advanced scientific fields like nanotechnology.
CO-4: Demonstrate the use of electroanalytical techniques such as voltammetry, polarography, and amperometry for qualitative and quantitative chemical analysis.

RM-CH106 Research Methodology [Credit 4, 60 Hours]

COURSE OUTCOMES (COs): Students will be able to-

CO-1: Demonstrate understanding of various research types, methodologies, and ethical considerations in scientific research.
CO-2: Perform effective literature search and critically evaluate scientific information using modern research databases and tools.
CO-3: Develop scientific reports, research proposals, and technical documents with appropriate structure, referencing tools, and scientific writing techniques.

CO-4: Apply quantitative techniques, computer applications, and presentation skills to analyze data and communicate scientific findings effectively.

Paper IV-CHT201: Inorganic Chemistry-II [Credit 4, 60 Hours]

COURSE OUTCOMES (COs): Students will be able to-

CO-1: Gain the periodic properties, bonding, structure, and reactivity of non-transition elements and their compounds.
CO-2: Analyze the properties, oxidation states, and spectral characteristics of lanthanides and actinides, and evaluate their industrial and chemical applications.
CO-3: Interpret crystal structures, electronic properties, and defects in solids, and describe the role of metal ions in biological systems.
CO-4: Demonstrate understanding of thermal analysis techniques (TGA, DTA, DSC) and apply them to interpret decomposition, phase transitions, and thermal behavior of materials.

Paper V-CHT202: Organic Chemistry-II [Credit 4, 60 L Hours]

COURSE OUTCOMES (COs): Students will be able to-

CO-1: Explain the mechanisms and synthetic applications of key organic rearrangement reactions and photochemical processes.
CO-2: Analyze various organic oxidation and reduction reactions using classical and modern reagents and catalysts.
CO-3: Apply the concepts of hydroboration, enamine chemistry, and functional group protection-deprotection in organic synthesis.
CO-4: Interpret organic molecular structures using advanced analytical techniques such as NMR and Mass Spectrometry.

Paper VI-CHT203: Physical Chemistry-II [Credit 4, 60 L Hours]

COURSE OUTCOMES (COs): Students will be able to-
CO-1: Apply the fundamental principles of quantum mechanics to solve problems involving wavefunctions, operators, and spectroscopic applications.
CO-2: Explain the concepts of electrochemistry including activity coefficients, electrode types, and electrokinetic phenomena with theoretical models.
CO-3: Analyse reaction kinetics using experimental methods, steady-state approximations, and catalytic mechanisms in homogeneous and heterogeneous systems.
CO-4: Describe the properties, classification, and applications of colloids, emulsions, and gels in analytical chemistry and research.

Inorganic Chemistry Practical [Credit 2, 60 Hours]

COURSE OUTCOMES (COs): Students will be able to

CO-1: Analyze the composition of ores and alloys through classical and instrumental analytical techniques.
CO-2: Synthesize coordination compounds and assess their purity using appropriate laboratory methods.
CO-3: Apply titrimetric, gravimetric, and colorimetric methods to determine the concentration of metal ions and non-metals in various samples.
CO-4: Utilize chromatographic and spectrophotometric techniques for separation and estimation of ions in complex mixtures.

Organic Chemistry Practical [Credit 2, 60 Hours]

COURSE OUTCOMES (COs): Students will be able to-

CO-1: Perform the separation and identification of binary organic mixtures using micro-analytical and TLC techniques.

CO-2: Prepare and characterize derivatives of organic compounds to confirm structure and purity.
CO-3: Estimate pharmaceutical and bioactive compounds such as ibuprofen, aspirin, isoniazid, and caffeine from various samples.
CO-4: Determine the composition and properties of industrial and natural products, including oils, soaps, and tea extracts, through quantitative organic analysis.

Physical Chemistry Practical [Credit 2, 60 Hours]

COURSE OUTCOMES (COs): Students will be able to-

CO-1: Learn advanced instruments and techniques, such as a conductometer, refractometer, pH meter, colourimeter, spectrometer, potentiometer, and polarimeter.
CO-2: Perform the calibration and handling of different instruments.
CO-3: Connect theoretical principles to observed phenomena and explain the underlying mechanisms.
CO-4: Analyse experimental data, identify trends, and interpret results in the context of theoretical knowledge.

OJT/FP-CH206: On Job Training/Field Project

The course will be run as per the guidelines of the Shivaji University and Government of Maharashtra. Under this course, students are required to enroll for On Job Training (OJT) or an internship or field projects in the relevant industries, or government departments, or research institutes, etc. This course is designed to offer students for gaining practical skills, hands-on experience that complements their academic learning and enhances their professional readiness.