# MARKAZ ARTS AND SCIENCE COLLEGE,ATHAVANAD

## MSc Chemistry

**Programme outcome**

P.O.1: Demonstrate comprehensive knowledge and systematic understanding of the fundamental concepts of Chemistry

P.O.2: Design and perform the chemical synthesis and characterise the products.

P.O.3: Design and execute experimental routines for detection and quantification of chemical entities and to write formal reports.

P.O.4: Analyse the kinetics and energetics of chemical processes and infer the mechanism.

P.O.5: Demonstrate the basic principles of instrumental methods of analysis and display proficiency in the operation of advanced instruments for chemical analysis

P.O.6 Display the skills in computational methods and related soft-wares to execute indepth analysis of chemical problems.

P.O.7: Work and communicate effectively in teams and uphold the ethical and cultural values.

## Course Outcome

### SEMESTER 1

### CHE1C01- QUANTUM MECHANICS AND COMPUTATIONAL CHEMISTRY

C.O.1: Describe the basic principles and concepts of quantum mechanics.

C.O.2: Apply the postulates of quantum mechanics to simple and complex systems, the particle-in-a-box, rotational and vibrational motion, harmonic oscillator, hydrogenic atoms.

C.O.3: Derive the variational principle and perturbation principle and use them to calculate properties for simple systems of chemical interest.

C.O.4: Differentiate the main similarities and differences between theoretical approaches .

C.O.5: Correlate the size dependent electronic properties with energy of three-dimensional box with varying length.

## CHE1C 02- ELEMENTARY INORGANIC CHEMISTRY

C.O.1: Apply various concepts of acids and bases – Arrhenius, Bronsted-Lowry, Solvent system, Lux-Flood, Lewis and Usanovich concepts HSAB concept

C.O.2: Predict the periodic anomalies of non-metals and post-transitional metals. Study the properties of various allotropes of C, Si, P. As, Sb, Bi, O, and Se. Predict the stability and topology of different polyhedral boranes and related compounds.

C.O.3: Describe the properties and applications of various silicates and amino silicates

C.O.4: Study the chemistry of transition metals and inner transition metals

C.O.5: Explain modern materials- nanomaterials, synthetic procedures and application of various nanomaterials .

## CHE1C03- STRUCTURE AND REACTIVITY OF ORGANIC COMPOUNDS

C.O.1: Study various interactions present in organic molecules and also delivers concept based on aromaticity.

C.O.2: Recognize the mechanistic aspects of substitution, addition and elimination reactions, considering various influencing factors

C.O.3: Analyse the concepts of conformation and configuration in organic chemistry.

C.O.4: Demonstrate strategies for the stereospecific / stereoselective organic transformations towards chiral target molecules.

C.O.5: Determine configuration of compounds with chiral centres (R and S), biphenyls, allenes, spiranes (E and Z) and draw the configurations in dash and wedge formula, or zig –zag configurations.

## CHE1C04- THERMODYNAMICS, KINETICS AND CATALYSIS

C.O.1: Apply the concepts of thermodynamics to derive relations between molecular properties and to predict spontaneity of processes.

C.O.2: Iinterpret dependence of chemical equilibrium on pressure, temperature and concentration.

C.O.3: Apply the laws of chemical kinetics to calculate rate / rate constants of different types of reactions

C.O.4: Calculate thermodynamic parameters from kinetic data and use adsorption isotherms as a tool for obtaining the surface area and rate constants in heterogeneous catalysis

C.O.5: Apply the principles of acid and enzyme catalysis to solve any given kinetic data.

## SEMESTER II

## CHE2C05- GROUP THEORY and CHEMICAL BONDING

C.O.1: Analyze the symmetrical aspects of any given molecule.

C.O.2: Apply symmetry and Group Theory in Quantum mechanics and spectroscopy.

C.O.3: Apply group theory to study the bonding in compounds

C.O.4: Describe the principles of chemical bonding in diatomic molecules and in polyatomic molecules.

C.O.5: Construct character table of the molecule and predict the spectral properties.

## CHE2C06—CO-ORDINATION CHEMISTRY

C.O.1: Understand the stereochemistry of coordination compounds and their Stability

C.O.2: Describe and explain the structure and bonding in metal complexes

C.O.3: Identify various d-d transitions and interpret the electronic spectra of any given transition metal complex.

C.O.4: Interpret the given transition metal complex with the aid of various spectroscopic techniques

C.O.5: Explain the various reaction mechanisms of coordination complexes and various photochemical reactions associated with complexes

## CHE2C07—REACTION MECHANISM IN ORGANIC CHEMISTRY

C.O.1: Analyze the mechanistic aspects of substitution, addition and elimination, considering various influencing factors.

C.O.2: Interpret structure, stability and various reactions involving intermediates of reactive intermediates.

C.O.3: Apply the concepts of Frontier orbital theory in the study of ionic, radical and pericyclic reactions.

C.O.4: Describe molecular structure, synthetic methodologies, rearrangement reactions and applications of various natural products.

C.O.5: Design molecular structure with various functional groups, which follows same kind of reaction mechanism as like as examples.

## CHE2C08—ELECTROCHEMISTRY, SOLID STATE CHEMISTRY AND STATISTICAL THERMODYNAMICS

Objective:

C.O.1: Describe the theories effecting ionic conductance and apply the concepts to calculate conductance behaviour of a given system .

C.O.2: Describe how diffraction patterns can be converted to structural information.

C.O.3: Explain the different types of statistics and calculate the thermodynamic probability of any given thermodynamic system.

C.O.4: Calculate the partition function and thermodynamic properties from spectroscopic data and apply the principles of statistical thermodynamics to ideal gases, solids and metals.

C.O.5: Predict the electrical properties of materials based on the valence band and conduction band energy level.

## CHE1L01 & CHE2L04 – INORGANIC CHEMISTRY PRACTICALS– I & II

C.O.1: Identify the cations in a mixture of unknown salts.

C.O.2: Estimate the amount of a given metal ion by complexometric and cerimetric reactions.

C.O.3: Perform colorimetric determination of various metal ions.

C.O.4: Design a quantitative method to analyse the concentration of various ions

## CHE1L02 & CHE2L05 – ORGANIC CHEMISTRY PRACTICALS– I & II

C.O.1: Acquire knowledge on safe laboratory practices of handling laboratory glassware, equipment and chemical reagents.

C.O.2: Separate organic compounds from the organic binary mixture and identify the functional group(s) present .

C.O.3: Plan and perform synthetic procedures .

C.O.4: Develop a method to separate various organic compound mixtures having more than two using distillation/crystallization/sublimation etc.

## CHE1L03 & CHE2L06 – PHYSICAL CHEMISTRY PRACTICALS– I & II

C.O.1: Perform experiments based on various laws of physical chemistry.

C.O.2: Interpret the results obtained from various experiments.

C.O.3: Operate various sophisticated instruments.

C.O.4: Construct phase diagram of various eutectic systems having binary mixture.

## SEMESTER III

## CHE3C09 – MOLECULAR SPECTROSCOPY

C.O.1: Explain the fundamental concept of molecular spectroscopy.

C.O.2: Correlate the structure-property relationship of molecule with UV-Visible and IR and magnetic resonance spectral data.

C.O.3: Describe and Interpret NMR and ESR spectra.

C.O.4: Elucidate the structural elucidation of organic compounds using electronic, vibrational and NMR spectroscopy .

C.O.5: Perform structural elucidation using mass spectrometry .

## CHE3C10 – ORGANOMETALLIC AND BIOINORGANIC CHEMISTRY

C.O.1: Distinguish the different types of ligands with respect to the type of interaction with the metal.

C.O. 2: Evaluate the structure, bonding and reactions of organometallic compounds and metal clusters.

C.O.3: Explain the application of reactions of organometallic complexes in homogeneous catalytic processes .

C.O.4: Predict the stability of organometallic compounds and metal clusters.

C.O.5: Identify the natural process taking place with the aid of metal in biological systems .

## CHE3C11 – REAGENTS AND TRANSFORMATIONS IN ORGANIC CHEMISTRY

C.O.1: Compare the differences in reactivity of various oxidizing agents with mechanistic illustrations.

C.O.2: Predict the reagents and conditions for the synthesis of specific target molecules.

C.O.3: Describe the synthesis and application of different types of polymers in laboratory and in industries.

C.O.4: Design synthetic scheme for heterocyclic aromatic and nonaromatic organic compounds.

C.O.5: Illustrate the mechanistic pathway of different rearrangements reactions, transformations and identify the products.

## CHE3E03- GREEN AND NANOCHEMISTRY (ELECTIVE)

C.O.1: Understand the basic principles and concepts of green chemistry.

C.O. 2: Describe and analyze the various green chemistry methodologies such as microwave assisted synthesis, solvent free reactions, green solvents, phase transfer catalyst etc.

C.O.3: Describe the synthesis approach of nanomaterials .

C.O.4: Characterization of nanomaterials with various techniques.

C.O.5: Interpret the structure and properties of various multi-functional nanomaterials.

# SEMESTER IV

## CHE4C12- INSTRUMENTAL METHODS OF ANALYSIS

C.O. 1: Explain the concepts of various conventional analytical techniques

C.O.2: Explain the theory, instrumentation and application of various electroanalytical techniques like coulometry, electrogravimetry, polarography and voltammetry and apply the concepts to solve the desired problems.

C.O.3: Explain the theory, instrumentation and applications of various optical methods of analysis.

C.O.4: Explain the instrumentation and applications of various surface characterization techniques.

C.O.5: Describe the theory, instrumentation and applications of chromatographic techniques and apply the same for solving related problems.

## CHE4E05 – INDUSTRIAL CATALYSIS (ELECTIVE)

C.O.1: Understand the adsorption and various kinds of adsorption isotherms

C.O.2: Adsorption isotherms as a tool for obtaining the surface area and rate constants in case of heterogeneous catalysis.

C.O.3: Basic concepts of phase transfer catalysis in organic reactions and biocatalysis.

C.O.4: Study on the industrial organic synthesis .

## CHE4E08 – ORGANOMETALLIC CHEMISTRY (ELECTIVE)

C.O.1: Distinguish the different types of ligands with respect to the type of interaction with the metal.

C.O.2: Evaluate the structure, bonding and reactions of organometallic compounds and metal clusters.

C.O.3: Explain the application of reactions of organometallic complexes in homogeneous catalytic processes.

C.O.4: Understand the structure and properties of organometallic polymers .

## CHE3L07 & CHE4L10 – INORGANIC CHEMISTRY PRACTICALS– III & IV

C.O.1: Studies involving quantitative separation of suitable binary mixtures of ions in solution.

C.O.2: Analyse the ion-exchange separation and estimation of binary mixtures

C.O.3: Learn the various synthesis of metal complexes.

## CHE3L08 & CHE4L11 – ORGANIC CHEMISTRY PRACTICALS– III & IV

C.O.1: Insight into the quantitative analysis of organic molecules using volumetric and spectrophotometric techniques.

C.O.2: Acquire an idea in identification as well as separation of mixtures by chromatographic techniques.

C.O.3: Describe the extraction of natural products and chromatographic techniques.

## CHE3L09 & CHE4L12 – PHYSICAL CHEMISTRY PRACTICALS– III & IV

C.O.1: Insights into the practical physical chemistry- kinetics, adsorption, phase diagram of three component system, cryoscopic methods

C.O.2: Learn the practical aspects of Computational chemistry.

C.O.3: Drawing adsorption isotherm.

C.O.4: Perform experiments using polarimeter and spectrophotometers.

## CHE4P01 & CHE4VO2 -Research Project & Viva Voice

C.O.1: Identify and hypothesise an advanced level research problem.

C.O.2: Design experiments and validate the hypothesis of an advanced level research problem.