# MSc CHEMISTRY

The objectives of the program are as follows

- To give students a comprehensive understanding of the principles of Chemistry
- To gain the skill to design and carry out scientific experiments and interpret the data
- To understand the interdisciplinary nature of Chemistry and to be aware of the emerging fields in Chemistry
- To build a scientific temper and to learn the necessary skills to succeed in research or industrial field.
- To be able to define and resolve new problems in Chemistry and participate in the future development of Chemistry

## COURSE OUTCOME

### SEMESTER 1

### CH500101 Organometallics and Nuclear chemistry

- To study the structure, synthesis and reactions of commonly known organometallic compounds
- To know the important applications of organometallic compounds in catalysis
- To study the important aspects of organometallic polymers
- To understand the functions and applications of bioorganic compounds
- To have a basic idea about nuclear Chemistry and its applications

### CH500102 Structural and Molecular Organic chemistry

- To understand the basic concepts and mechanism in organic chemistry
- To get an idea about the various kinetic and thermodynamic factors which control the organic reactions
- To know stereochemistry and various possible conformations of organic compounds and how it affects the reaction outcome
- To be familiarise with the important photochemical reactions in Organic Chemistry

### CH500103 Quantum chemistry and Group Theory

- To study the basic postulates of quantum mechanics
- To enable the students to solve the simple quantum mechanical models such as simple harmonic oscillator, particle in a 1D- box, rigid rotor, H atom etc.
- To understand the quantum mechanical aspect of angular momentum and spin.

- Enable the students to predict the point group of important molecules and to know how they are classified
- To understand the idea of space groups and to learn the theory of molecular symmetry.
- To gain skill to apply group theory to vibrational and electronic spectroscopy

**CH500104 Thermodynamics, Kinetic Theory and Statistical Thermodynamics**

- To know the basic concepts in classical thermodynamics and to learn the thermodynamic aspects of various processes and reactions
- To understand the different aspects of statistical thermodynamics and its applications.

**SEMESTER 2**

**CH500201 Coordination chemistry**

- To know the structure and bonding of important coordination compounds
- To understand the magnetic properties of complexes and to know how magnetic moments can be employed for the interpretation of their structure
- To get an overview about the stereochemistry of coordination compounds
- To study the reaction mechanisms of metal complexes.
- Enable the students to elucidate the structure of metal complexes using various spec troscopic methods
- To get an idea about the basic coordination chemistry of Lanthanides and Actinides

**CH500202 Organic Reaction Mechanism**

- To be familiarise with the mechanism of organic reactions and different factors which affect the reaction rate.
- To understand the role of various reaction intermediates like carbanion, carbocation, carbenes, radicals etc. in organic reactions
- To get insight into the chemistry of carbonyl compounds.
- To know the different types of concerted reactions in organic chemistry and orbital correlation approaches

**CH500203 Chemical Bonding and Computational chemistry**

- To understand the requirement of approximation methods in quantum mechanics
- To gain the knowledge to apply important approximation methods to problems in quantum mechanics
- To gain insight in to valance bond theory molecular orbital theory and the concept of hybridisation
- To know the applications of group theory in chemical bonding
- To get an exposure to the emerging world of computational chemistry
- To have a basic idea about computational chemistry calculations

**CH5002C04 Molecular Spectroscopy**

- To know the basics principle of different techniques employed in molecular spectroscopy
- To study the origin, instrumentation and important applications of Microwave, IR, Raman, UV, NMR, EPR and EQR techniques

**SEMESTERS 1 & 2 PRACTICAL**
**CH500205 Inorganic chemistry Practical-1**

- To be able to identify and separate less familiar ions such as Tl, W, Se, Mo, Ce, Th, Ti, Zr, V, U etc.
- To be able to estimate colorimetrically ions such as Fe, Cu, Ni, Mn, Cr etc.

**CH500206 Organic chemistry Practical-1**

- To learn the separation and purification of an organic mixture by chemical/solvent separation methods.
- To gain the knowledge to draw the structure of compounds using Chemdraw software

**CH500207 Physical chemistry Practical-1**

- To verify the some important principles in physical chemistry and to determine various physical properties
- To learn to carry out some simple computational chemistry calculations

**SEMESTER 3**

**CH500301 Structural Inorganic chemistry**

- To understand the structure and different properties of solids
- To learn the important aspects of inorganic chains, rings, cages and metal clusters.
- To understand the chemistry and applications of materials such as glasses, ceramics, composites, nanomaterials etc.

**CH500302 Organic Syntheses**

- To know the various methods employed for reactions like oxidation, reduction, carbocyclic and heterocyclic ring formation etc.
- To get insights into novel reactions and reagents in organic synthesis
- To know the utility of protecting group strategy in organic synthesis
- To be familiarise the students with the basic principles of retro syntheses, biosynthesis and biomimetic synthesis

**CH010303 Chemical Kinetics, Surface chemistry and Crystallography**

- To learn the different theories of reaction rates and factors affecting reaction rates
- To have an idea about the different types of catalysis and their mechanisms
- To study the chemistry of surfaces and different types of surface phenomena
- To get an idea about the various techniques employed for the characterisation of surfaces
- To know the general properties of colloids and macromolecules
- To have an idea about the important aspects of crystallography

**CH500304 Spectroscopic Methods in chemistry**

- To get a deep insight into the various spectroscopic methods used for the characterisation of organic compounds.
- Enable the students to elucidate the structure of compounds by analysing the spectral data

**SEMESTER 4**

**ELECTIVE COURSES**

**CH800401 Advanced Inorganic chemistry**

- To understand the applicability of group theory in coordination chemistry
- To know the utility of spectroscopic methods such as IR, Raman, EPR and Mossbauer techniques for the characterisation of inorganic complexes
- To understand the photochemistry of inorganic compounds
- Introduce the students the emerging field of nanochemistry and its fascinating aspects
- To study the acid –base concept in non-aqueous media and reactions in non-aqueous media

**CH800402 Advanced Organic chemistry**

- To get a brief idea about emerging branches in chemistry like supramolecular chemistry, nanochemistry, medicinal chemistry, polymer chemistry and its applications
- To learn the principles of green chemistry and to know the various green protocols in organic synthesis
- To study the important stereoselective transformations in organic synthesis
- To know the basic aspects of natural product chemistry.
- To get an overview about research process and to gain the ability to apply various research methods and techniques.

**CH800403 Advanced Physical chemistry**

- To get an overview about the structure and properties of of solid crystals and liquid crystals
- To know the characterisation of crystals using X-Ray diffraction
- To learn the important aspects of gaseous state and electrochemistry
- To study the principle, instrumentation and applications of diffraction method, fluorescence spectroscopy, atomic spectroscopy and electroanalytical techniques.

**PRACTICAL- SEMESTERS 3 AND 4**

**CH010405 Inorganic chemistry practical-2**

- Enable the students to estimate the binary mixtures of metallic ions by volumetric and gravimetric methods
- To acquire the skill to analyse some common alloys and ores.

**CH010406 Organic chemistry practical-2**

- To gain the skill to prepare organic compounds using greener protocols
- Enable the students to prepare organic compounds via two step synthetic sequences
- To know about enzyme/coenzyme catalysed reactions

**CH010407 Physical chemistry practical-2**

- Enable the students to determine the various physical properties using simple instrumental methods like polarimetry, refractometry etc.