Department of Chemistry
Program: MSc Chemistry
PSO, PLO & CLO

PROGRAM SPECIFIC OBJECTIVES (PSOs)

The objectives of the M.Sc. Chemistry program are to develop students with the following capabilities:

PSO1: Grasp the concepts while teaching in classes.

PSO2: Interpret and analyze the questions.

PSO3: Bridge the multiple concepts of various topics via numerical and Practicals/Project.

PSO4: Extract critical knowledge from the comprehensive topics.

PSO5: Ability to write & review of scientific articles

PROGRAM LEARNING OUTCOMES (PLOs)

After successful completion of this program, the students will be able to:

PLO1: Have a firm foundation in the fundamentals and application of current chemical and scientific theories including those in Analytical, Inorganic, Organic and Physical Chemistry.

PLO2: Think critically and analyze chemical problems.

PLO3: Present scientific and technical information resulting from laboratory should broaden their professional foundations through activities such as teaching, internships, and fellowships.

PLO4: Use technologies/instrumentation to gather and analyze data.

PLO5: Communicate scientific results in writing and in oral presentation.

PLO6: Acquire the basic tools needed to carry out independent chemical research.

PLO7: Be proficient in their specialized area of chemistry and successfully complete an advanced research project.

PLO8: Describe the common methods of spectroscopic and chromatographic analysis, and discuss how they can be applied to pharmaceuticals.

SEMESTER – I

Inorganic Chemistry-I (Coordination Compounds and Rare Earth Metals)	
Course Code: 23CYMS101	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P: 4 0 0	**Course Type: Core Course**

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with UGC regulations. After completion of course, students would be able to:

- Apply various theories of coordination compounds to explain their properties.
- Describe the electronic spectra of various transition metal complexes.
- Explain the various reaction mechanisms for synthetic inorganic chemistry.
- Correlate between properties of inorganic compounds containing f-block elements of the periodic table as the central metal ion and their properties.

Organic Chemistry-I (GOC and Stereochemistry)	
Course Code: 23CYMS102	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 4 0 0	**Course Type: Core Course**

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with UGC regulations. After completion of course, students would be able to:

- Explain the formation, reactivity and stability of reactive intermediates.
- Illustrate the basic concept of symmetry and chirality in the molecules their spatial arrangement, properties and reactivity of stereoisomers, importance of the configuration of chiral organic compounds.
- Describe the stereochemistry of N-heterocyclic system and dynamic stereochemistry.
- Demonstrate the knowledge on reaction mechanism & structure and reactivity involved in organic molecules.

Physical Chemistry-I (Quantum Chemistry and Chemical Kinetics)	
Course Code: 23CYMS103	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 4 0 0	**Course Type: Core Course**

COURSE LEARNING OUTCOMES (CLOs):

The syllabus has been prepared in accordance with UGC regulations. After completion of course, students would be able to:

- Describe the postulates of quantum chemistry and apply to obtain the expression for uncertainty principles and other quantum mechanical system.
- Apply the concept of quantum chemistry to get the wave functions, probability and energy of various models and systems.
- Demonstrate different theories of chemical kinetics.

- Illustrate the use of theories of chemical kinetics to different types of chemical and biochemical reactions.

Inorganic Chemistry Practical – I	
Course Code: 23CYMS151	Continuous Evaluation: 60 Marks
Credits: 2	End Semester Practical Examination: 40 Marks
L T P : 0 0 4	**Course Type: Core Course**

COURSE LEARNING OUTCOMES (CLOs):

The syllabus has been prepared in accordance with UGC regulations. After completion of course, students would be able to:

- Apply concepts of inorganic chemistry to perform the water analysis.
- Comprehend the principle, mechanism and will receive hands-on training to separate mixture of metal ions by gravimetric analysis.
- Synthesize, isolate, and characterize inorganic compounds.

Organic Chemistry Practical – I	
Course Code: 23CYMS152	Continuous Evaluation: 60 Marks
Credits: 2	End Semester Practical Examination: 40 Marks
L T P : 0 0 4	**Course Type: Core Course**
Prerequisite:	

COURSE LEARNING OUTCOMES (CLOs):

The syllabus has been prepared in accordance with UGC regulations. After completion of course, students would be able to:

- Demonstrate safe laboratory practices by handling laboratory glassware, equipment, and chemical reagents.
- Perform synthetic procedures, starting materials, functional groups, mechanism, and typical reaction conditions.
- Replicate the mono & bi-functional groups in organic compounds.
- Execute characterization by physical and spectroscopic techniques.

Physical Chemistry Practical – I	
Course Code: 23CYMS153	Continuous Evaluation: 60 Marks
Credits: 2	End Semester Practical Examination: 40 Marks
L T P: 0 0 4	**Course Type: Core Course**

COURSE LEARNING OUTCOMES (CLOs):

The syllabus has been prepared in accordance with UGC regulations. After completion of course, students would be able to:

- Perform the kinetics of various reactions by different methods.
- Apply distribution law in various systems.
- Describe the concept of phase equilibria & prepare phase diagram.

SEMESTER II

Inorganic Chemistry-II (Organometallic Chemistry)	
Course Code: 23CYMS201	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P: 4 0 0	**Course Type: Core Course**

COURSE LEARNING OUTCOMES (CLO):

- The syllabus has been prepared in accordance with UGC regulations. After completion of course, students would be able to:
- Describe the fundamental understanding of organometallic compounds.
- Demonstrate bonding, properties & reactions of metal carbene, metal carbyne & fluxional organometallic compounds.
- Replicate various catalytic reactions by using transition metal catalyst.
- Explain the structure & bonding of low & high nuclear metal cluster.

Organic Chemistry-II (Organic Spectra and Reagents)	
Course Code: 23CYMS202	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P: 4 0 0	**Course Type: Core Course**

COURSE LEARNING OUTCOMES (CLOs):

The syllabus has been prepared in accordance with UGC regulations. After completion of course, students would be able to:

- Demonstrate the principles of IR spectroscopy for the structure determination of organic compounds.
- Apply the principles of UV spectroscopy and Mass spectrometry for the structure determination of organic compounds.
- Apply the basic principles of NMR spectroscopy such as chemical shift, coupling constant, and anisotropy in the characterization of compounds.
- Illustrate various reducing and oxidizing agents and their applications in organic synthesis.

Physical Chemistry - II (Statistical Thermodynamics and Electrochemistry)	
Course Code: 23CYMS203	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P: 4 0 0	**Course Type: Core Course**

The syllabus has been prepared in accordance with UGC regulations. After completion of course, students would be able to:

- Explain concept of statistical thermodynamics and various types of systems.
- Demonstrate the applications of statistical thermodynamics in determination of partition function.
- Analyze the ion-ion interactions and its limitations in electrochemistry.
- Describe the ion transport in solution under different environment.

Inorganic Chemistry Practical – II	
Course Code: 23CYMS251	Continuous Evaluation: 60 Marks
Credits: 2	End Semester Practical Examination: 40 Marks
L T P: 0 0 4	**Course Type: Core Course**

COURSE LEARNING OUTCOMES (CLO);

The syllabus has been prepared in accordance with UGC regulations. After completion of course, students would be able to:

- Comprehend the underlying principle how to identify various anions present in inorganic salt mixture qualitatively.
- Apply different strategies to evaluate various cations present in inorganic salt mixture qualitatively.

Inorganic Chemistry Practical – II	
Course Code: 23CYMS252	Continuous Evaluation: 40
Credits: 2	End Semester Practical Examination: 60 Marks
L T P: 0 0 4	**Course Type: Core Course**

COURSE LEARNING OUTCOMES (CLO):

. The syllabus has been prepared in accordance with UGC regulations. After completion of course, students would be able to:

- Demonstrate the separation and identification of compounds.
- Execute synthesis of organic compounds and related steps such as aqueous workup, distillation, reflux, separation, isolation, and crystallization.

Physical Chemistry Practical – II	
Course Code: 23CYMS253	Continuous Evaluation: 40
Credits: 2	End Semester Practical Examination: 60 Marks
L T P: 0 0 4	**Course Type: Core Course**

COURSE LEARNING OUTCOMES (CLO):

. The syllabus has been prepared in accordance with UGC regulations. After completion of course, students would be able to:

- Replicate potentiometric and conductometric titration of acid and base to study the details of rates of chemical reactions.
- Apply the principles of Thermochemistry in the determination of heat of reaction.

SEMESTER III

Structure & Mechanism in Organic Chemistry	
Course Code: 23CYMS301	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P: 4 0 0	**Course Type: Core Course**

COURSE LEARNING OUTCOMES (CLO):

. The syllabus has been prepared in accordance with UGC regulations. After completion of course, students would be able to:

- Describe various nucleophiles and electrophiles and their reactions. Will also get to know about the various factors which affects the rate and outcomes of electrophilic &nucleophilic substitution reactions.
- Explain the various types of reactions involving arenium ion as in intermediate.
- Explain the role of free radicals in organic chemistry and in reaction mechanism.
- Apply the knowledge about the mechanistic and stereochemical aspects of addition reactions of C=C and C=X.

Inorganic and Physical Spectroscopy	
Course Code: 23CYMS302	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P: 4 0 0	**Course Type: Core Course**

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with UGC regulations. After completion of course, students would be able to:

- Describe the concepts of vibrational spectroscopy and IR spectra of molecules.
- Apply the concepts of Raman spectroscopic techniques to characterize different molecules and crystals.
- Demonstrate the electronic and spin resonance spectroscopy in molecular characterization.
- Explain the characterization of materials using Mossbauer and Atomic Absorption Spectroscopy.

Bio-Inorganic and Bio-Organic Chemistry	
Course Code: 23CYMS303	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P: 4 0 0	**Course Type: Core Course**

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with UGC regulations. After completion of course, students would be able to:

- Describe the function of alkali and alkaline earth metals in biological system & their role as biological carriers
- Analyze the importance, function & mechanism of various metalloenzymes

- Explain various classes of carbohydrates, their roles, synthesis & stereochemistry.
- Identify various biomolecules such as nucleic acids, amino acids & proteins, their roles, synthesis & properties.

Photochemistry & Pericyclic Chemistry	
Course Code: 23CYMS304	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 4 0 0	**Course Type: Core Course**

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with UGC regulations. After completion of course, students would be able to:

- Describe concept of photochemistry and their applications in carbonyl compounds.
- Illustrate the intermolecular rearrangement in olefinic and carbonyl compounds.
- Apply the molecular orbital symmetry and possibility of thermal and photo-chemical pericyclic reactions of electro-cyclic reactions
- Explain cycloaddition reaction and sigmatropic reactions such as Diels alder reactions, Claisen rearrangement, ene reactions etc.

Chemistry Practical – III	
Course Code: 23CYMS351	Continuous Evaluation: 40 Marks
Credits: 2	End Semester Practical Examination: 60 Marks
L T P: 0 0 4	**Course Type: Core Course**

COURSE LEARNING OUTCOMES (CLO):

. The syllabus has been prepared in accordance with UGC regulations. After completion of course, students would be able to:

- Synthesize, and characterize inorganic compounds.
- Describe various techniques used in isolation of organic compounds from natural sources.
- Demonstrate the synthesis and characterization of nanoparticles
- Analyze the effect on conductance as the number of ions increases or decreases.

Chemistry Practical – IV	
Course Code: 23CYMS352	Continuous Evaluation: 40 Marks
Credits: 2	End Semester Practical Examination: 60 Marks
L T P: 0 0 4	Course Type: Core Course

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with UGC regulations. After completion of course, students would be able to:

- Perform the multi-step synthesis of organic compounds.
- Preparation of polymers
- Apply polarimetry to study the progress of chemical reactions.

SEMESTER-IV

Subject Name: Applications of Group Theory in Chemistry	
Course Code: 24CYMS401	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P: 4 0 0	**Course Type: Core Course**

COURSE LEARNING OUTCOMES (CLO):

. The syllabus has been prepared in accordance with UGC regulations. After completion of course, students would be able to:

- Work out the symmetry point groups of molecules.
- Derive the character table and obtain the Mulliken symbol and irreducible representation for various point group molecules.
- Obtain normal modes of vibrations and the spectroscopic transition for various molecular point group.
- Apply the concepts of symmetry of hybrid orbitals for sigma and pi bonding and for the symmetry adapted linear combination of atomic orbitals.

Natural Products and Protecting Agents	
Course Code: 24CYMS402	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P: 4 0 0	**Course Type: Core Course**

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with UGC regulations. After completion of course, students would be able to:

- Explain natural products, their types and synthesis.
- Describe the chemistry of proteins, enzymes or carbohydrates and their structure determination methods.
- Demonstrate heterocyclic compounds with respect to their structure, synthesis and reactions.
- Lay out the different types of protecting groups used in organic synthesis and their purpose.

Retrosynthesis and Disconnection Approach in Organic Synthesis	
Course Code: 23CYMS403	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 4 0 0	**Course Type: Core Course**

COURSE OUTCOMES: The syllabus has been prepared in accordance with UGC regulation. After completion of course, students would be able to:

- Describe the basic term in retro analysis.
- Explain the strategies involved in disconnection approach for one C-X and two C-X group disconnection.
- Design a synthetic scheme for synthesis of organic molecules.
- Apply the concept of retrosynthetic in organic and process chemistry.

Chemistry Practical – V	
Course Code: 23CYMS451	Continuous Evaluation: 40 Marks
Credits: 2	End Semester Practical Examination:60
L T P : 0 0 4	**Course Type: Core Course**

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with UGC regulations. After completion of course, students would be able to:

- Demonstrate the effect on conductance as number of ions increases or decreases.
- Describe light interaction with matter through study of optically active substances.

Chemistry Practical – VI	
Course Code: 23CYMS452	Continuous Evaluation: 40 Marks
Credits: 2	End Semester Practical Examination: 60
L T P: 0 0 4	**Course Type: Core Course**

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with UGC regulations. After completion of course, students would be able to:

- Demonstrate preparation and characterization of nanoparticles.
- Isolate some important moiety from plant sources.
- Synthesize particular compound using multi-step approach.

GENERIC ELECTIVE COURSE (GE-I & II)

Mathematics for Chemists	
Course Code: 23GECY101	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 4 0 0	**Course Type: Generic**
Prerequisite:	

COURSE LEARNING OUTCOMES (CLO):

. The syllabus has been prepared in accordance with UGC regulations. After completion of course, students would be able to:

- Explain the basic concepts of Vector analysis
- Apply the concept of differential calculus used in chemistry.
- Solve problems related to matrices & determinants in chemistry.
- Apply the concept of integral calculus used in chemistry.

Computer for Chemists	
Course Code: 23GECY102	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60
L T P : 4 0 0	**Course Type: Generic**
Prerequisite:	

COURSE LEARNING OUTCOMES (CLO):

. The syllabus has been prepared in accordance with UGC regulations. After completion of course, students would be able to:

- oExplain the basic knowledge of Python like data types &implementing conditional loops with the help of few examples.
- oApply basic operators on the text file using python fundamentals and implementing few Machine learning algorithms.
- oIllustrate reaction mechanism along with theoretical calculations.
- oPerform molecular docking.

Biology for Chemists	
Course Code: 23GECY201	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 4 0 0	**Course Type: Generic**
Prerequisite:	

COURSE LEARNING OUTCOMES (CLO):

. The syllabus has been prepared in accordance with UGC regulations. After completion of course, students would be able to:

- oExplain the structure and function of cells and metabolic process inside the body.
- oAnalyze the structure and function of carbohydrates & lipids.
- oDescribe the structure of proteins as well their functioning in biological systems.
- oInvestigate the structure and function of nucleic acids and genetic information.

Intellectual Property Rights (IPR)	
Course Code: 23GECY202	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 4 0 0	**Course Type: Generic**
Prerequisite:	

COURSE LEARNING OUTCOMES (CLO):

. The syllabus has been prepared in accordance with UGC regulations. After completion of course, students would be able to:

- oDescribe the theoretical concepts of evolution of Intellectual Property Laws, and to differentiate between the different kinds of IP.
- oExplain the basic knowledge of trademarks, Industrial Designs, patents & know the role of government through case studies.
- oExplain the basic knowledge of copy rights, Geographical Indications, trade secret & know the role of government through case studies.
- oDescribe the various Different International agreements & the value of various IP's.

DISCIPLINE SPECIFIC ELECTIVE COURSE (DSE)

Green Chemistry	
Course Code: 23CYMS305	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 4 0 0	**Course Type: DSE**
Prerequisite:	

COURSE LEARNING OUTCOMES (CLO):

. The syllabus has been prepared in accordance with UGC regulations. After completion of course, students would be able to:

- Describe the stoichiometric calculations and relate them to green chemistry metrics. Understand benefits of use of catalyst and bio catalyst, use of renewable feed stock which helps in energy efficiency and protection of the environment, renewable energy sources.
- Explain to design safer chemical, products and processes that are less toxic, than current alternatives.
- Describe the use of green chemistry in problem solving skills, critical thinking and valuable skills to innovate and find out solution to environmental problems.
- Illustrate the future trends in green chemistry.

Analytical Chemistry	
Course Code: 23CYMS306	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 4 0 0	**Course Type: DSE**
Prerequisite:	

COURSE LEARNING OUTCOMES (CLO):

. The syllabus has been prepared in accordance with UGC regulations. After completion of course, students would be able to:

- Demonstrate proper sampling procedure and data analysis.
- Apply optical method to analyze the samples.
- Explain and analyze the electroanalytical and thermal analysis.
- Select the proper methods of solvent extraction and chromatography.

Pharmaceutical Chemistry	
Course Code: 23CYMS307	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 4 0 0	**Course Type: DSE**
Prerequisite:	

COURSE LEARNING OUTCOMES (CLO):

. The syllabus has been prepared in accordance with UGC regulations. After completion of course, students would be able to:

- Illustrate drug design, discovery and mode of action.
- Describe various classes of antibiotics & their mode of action.
- Explain functioning of Prostaglandins, Antipyretic-& analgesics.
- Discuss the mode of action of antihypertensive & Contraceptive agents.

Polymer Science & Medicinal Chemistry	
Course Code: 21CYMS404A	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 4 0 0	**Course Type: DSE**
Prerequisite:	

COURSE LEARNING OUTCOMES (CLO):

. The syllabus has been prepared in accordance with UGC regulations. After completion of course, students would be able to:

- Explain the organic and inorganic polymers and properties and their applications.
- Describe inorganic polymers & their uses.
- Identify basic concept regarding development of drugs and drugs work inside the body.
- Explain about the historical development of drugs.

Chemistry in Industry & Environment	
Course Code: 23CYMS404B	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 4 0 0	**Course Type: DSE**

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Identify toxicity hazards of toxic gases, safe design systems for large scale production of industrial gases, manufacturing processes handling and storage of inorganic chemicals.
- Explain the hazardous effects of the inorganic chemicals on human beings and vegetation &the advantages of Green Chemistry over conventional methods.
- Describe about various perfume formulations & their synthesis used in perfumery industry.
- Demonstrate the processes that are used in milk & alcohol Industry.

Solid State & Nuclear Chemistry	
Course Code: 23CYMS404C	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 4 0 0	**Course Type: DSE**

COURSE LEARNING OUTCOMES (CLO):

. The syllabus has been prepared in accordance with UGC regulations. After completion of course, students would be able to:

- Illustrate the basic concept of Nuclear Chemistry and their applications.
- Explain the internal structures and properties of solid materials.
- Apply X-Ray diffraction techniques in the characterization of materials.
- Demonstrate different methods of synthesis of solid materials.