

Name of the Programme: M.Sc. Chemistry

POSTGRADUATE PROGRAMME: PROGRAM OUTCOMES (POs) :

After successfully completing the M. Sc. Organic Chemistry program students will be able to

1. Learn the terms, theories, assumptions, methods, principles, theorem statements and classification.
2. Fix out the problem and resolve it using theories and practical knowledge.
3. Inculcate knowledge for carrying projects and advanced research related skills.
4. Actively participate in team on case studies and field-based situations.
5. Analyze and interpret ideas, evidences and experiences with learned scientific reasoning.
6. Aware and implement the subject facts that can be applied for the personal and social development.
7. Use digital literacy to retrieve and evaluate subject related information.
8. Get moral and ethical values for society as well as in research.
9. Give analytical reasoning to interpret research data.
10. Improve their managerial skills and abilities in subject related activities.
11. Inculcate continuous learning habit through all available resources.
12. To define a problem, analyse, interpret and draw conclusion by planning, implementing and reporting the results of an experiment.

POSTGRADUATE PROGRAMME: COURSE OUTCOMES (COs) :

Name of the Class	Course Code	Course Title	Course Outcomes	
SEMESTER I				
M.Sc. I	CHE-501	Physical Chemistry-I	CO1	Students should be able to remember the concepts of thermodynamic parameters, quantum mechanical postulates, rate laws of chemical reactions and computation of macroscopic properties of matter.
			CO2	Students should understand the basics like state function and path function, Schrodinger wave equation, kinetics of fast reactions, partition functions and ensembles.
			CO3	Students should be able to apply the knowledge of various quantum mechanical methods to determine the different molecular properties and built the concept of the relation between thermodynamics and quantum mechanics.
			CO4	Students should be able to analyze the rates of various chemical reactions both theoretically and experimentally and also observe the effect of catalyst and determine energies of activation of such reactions.
			CO5	Students should be able to evaluate variation of thermodynamic parameters for multi component systems and their variation with other extensive properties, Schrodinger wave equation and its application to hydrogen and hydrogen like atoms.
			CO6	Students should be able to create the solutions to avoid excess use of energy in chemical reactions by applying their knowledge of thermodynamics and chemical kinetics.
M.Sc. I	CHEO D-502	Inorganic Chemistry-I	CO1	Define symmetry elements and symmetry operations, classes, properties of a group, group multiplication table, etc.
			CO2	Classify symmetry elements, point group, Group, sub-group and classes.
			CO3	Use wave function as basis for determination of irreducible representations and the Great Orthogonality theorem and its consequence.
			CO4	Solve problem based on point group, matrix representation and character table
			CO5	Construct character table of various point

				group
			CO6	Justify which can take part in bonding on the basis of SALCs and point group of molecules.
M.Sc. I	CHE-503	Organic Chemistry-I	CO1	Understand the concepts of chemical bonding, various structural effects, acids and bases, intermediates and aromaticity.
			CO2	Learn the concepts of stereochemistry.
			CO3	Understand and identify the types of organic reactions.
			CO4	Advanced knowledge of various stereochemical aspects.
			CO5	Establish mechanistic knowledge of aliphatic and aromatic substitutions, and oxidation-reduction reactions
			CO6	Develop problem solving ability of the students.
M.Sc. I	CHE-504	Physical Chemistry Practical I	CO1	Students will grasp the concept of reaction rate and its significance in Chemical Kinetics.
			CO2	Students will learn how to use experimental data to deduce rate laws and rate constants
			CO3	Students will be familiar with the fundamental principles of colorimetry and spectrophotometry including Beer's law, Lambert- Beer's law and the relationship between absorbance and concentration.
			CO4	Students will be able to operate the instruments like spectrophotometer and colorimeter.
			CO5	Students will be able to determine the densities of the solutions and can calculate molar volumes
M.Sc. I	CHE-505	Inorganic Chemistry Practical-I (Inorganic Material analysis, Synthesis and Its Applications)	CO1	Prepare solution of required conc. and the handle laboratory equipment properly.
			CO2	Perform experiment accurately and able to perform calculation.
			CO3	Explain experiment and principal of experiment in detail.
			CO4	Perform calculations and discuss results and write conclusions of the experiment.

			CO5	Apply knowledge to a) design experiment for given aim or modify experiment to enhance results. b) to find out lacuna in experimental procedure.
			CO6	Solve problem/ numerical depending on given experimental data / information.
M.Sc. I	CHE-506,	Organic Chemistry Practical I (Single stage preparation and purification techniques)	CO1	Understand the theoretical aspects behind separation, purification and synthesis of organic compounds.
			CO2	Acquire the experimental skills for separation, purification, identification and synthesis of organic compounds.
			CO3	Design experimental set up for performing the organic reactions.
			CO4	Monitor the organic reactions.
			CO5	Describe the mechanistic aspects of organic reactions.
			CO6	Develop problem solving ability.
M.Sc. I	CHE-507(C)	Analytical Chemistry	CO1	Define/memorize GLP, Lab Safety, Quality assurance
			CO2	Discuss good laboratory practices, laboratory emergencies, and mass spectrometry
			CO3	Apply their knowledge to prepare quality assurance reports, emergencies in the laboratory
			CO4	Differentiate between different ionization technique, compare hazardous and nonhazardous material handling
			CO5	Explain the Quality Assurance, Laboratory Accreditation, Laboratory Emergencies, different ionization technique
			CO6	Applications of GLP, Lab Safety, mass spectrometry
M.Sc-I	CHE-508,	Research methodology	CO1	Develop a comprehensive understanding of different research methodologies and their applications in mathematics.
			CO2	Cultivate critical thinking and analytical skills necessary for identifying research problems and formulating research questions.
			CO3	Provide practical experience in designing experiments, collecting and analyzing

				data, and interpreting research results
			CO4	Foster effective communication skills for presenting research findings orally and in written form.
			CO5	Promote ethical research practices and awareness of responsible conduct in mathematical research
			CO6	Develop problem solving ability

SEMESTER II

M.Sc-I	CHEOD-551	Physical Chemistry-II (Molecular Spectroscopy)	CO1	Remember basic concepts of molecular spectroscopy, selection rules, intensity of spectral lines and width of spectral transition.
			CO2	Understand principles and applications of rotational, vibrational, raman, electronic and mossbauer spectroscopy.
			CO3	Apply various spectroscopic techniques for gaining insights into molecular structure
			CO4	Analyse vibrating diatomic molecule, simple harmonic and anharmonic oscillator, Scattering of light and Raman Spectrum.
			CO5	Evaluate bond length, vibrational frequency, force constant and dissociation energy using spectral data.
			CO6	Create awareness about rotational fine structure, vibrational coarse structure, Quadrupole effects
M.Sc. I	CHE-552	CHE-552: Inorganic Chemistry-II (Coordination and Bioinorganic Chemistry)	CO1	Define R. S. term, configuration, microstate, paramagnetic, diamagnetic ferromagnetic, antiferromagnetic, Curie and Neel temperature.
			CO2	Identify complex ions showing same R.S. terms, degeneracy of ground state terms of metal ions, and spin multiplicities of different configurations.
			CO3	Interpret electronic spectra for spin allowed Oh and Td complexes using Orgel diagram, Magnetic properties of A, E and T ground terms in complexes and selection rules.

			CO4	Calculate frequencies of absorption spectrum, $10Dq$, Racah and nephelauxetic parameter for a complex, and magnetic moments of complexes
			CO5	Define metalloproteins, metallo-enzymes, photosynthesis, HSAB concept, nucleic acids, metalloregulation, Biopolymer effects and acetylcholine receptor.
			CO6	Explain chelate effect and Irving-William series, pK_a values of coordinated ligands, Tuning of redox potential, and Reactions of coordinated ligands.
			CO7	Describe Fe-S clusters, model compounds and spontaneous self-assembly, metals in medicine, blue copper proteins, and cytochromes, and Na/K pumps.
			CO8	Distinguish between hemoglobin and myoglobin, transferrin and ferritin, photosystem-I and photosystem-II.
M.Sc. I	CHE-553	Organic Chemistry-II (Pericyclic Reactions, Molecular Rearrangements, Photochemistry and Organic Spectroscopy)	CO1	Understand the concepts of pericyclic and photochemical reactions, and molecular rearrangements
			CO2	Learn concepts of Organic Spectroscopy.
			CO3	Identify the type of pericyclic and photochemical reactions
			CO4	Solve the problems based on pericyclic and photochemical reactions and molecular rearrangements
			CO5	Deduce the structure from the spectral data and justify the findings
			CO6	Develop problem solving ability of the students.
M.Sc. I	CHE-554	Physical Chemistry Practical II	CO1	Students will grasp the fundamental principles of Conductometry, Polarography, Potentiometry and pHmetry.
			CO2	Students will familiar with the operation of Conductometer, Polarimeter, Potentiometer and pH meter
			CO3	Students will understand the concepts of conductance, resistance and learn how to calculate and interpret these values.

			CO4	Students will learn to interpret polarographic waves and understand their significance in identifying electroactive species and determining their concentration.
			CO5	Students will explore the applications of Potentiometry in various fields such as acid- base titrations, determination of pH and analysis of ionic concentration
M.Sc. I	CHE-555	Inorganic Chemistry Practical-II	CO1	Define coordination complex, cell constant, resistance, specific conductance, equilibrium constant, absorbance, Beer's law, solubility product, chromatography, etc.
			CO2	Discuss photochemistry of potassium trioxalatoferate complex, kinetics of formation of Cr(III)-EDTA, Determination of Cu(II) and Fe (II) by solvent extraction technique.
			CO3	Outline the flow-chart for synthesis of [Mn(acac) ₃], Chloropentaamminecobalt(III) chloride, Nitro pentaamminecobalt(III) chloride, Bis[TrisCu(I)thiourea complexes.
			CO4	Estimate purity of the [Mn(acac) ₃], Chloropentaamminecobalt(III) chloride, Nitro pentaamminecobalt(III) chloride, Bis[TrisCu(I)thiourea complexes.
			CO5	Determine equilibrium constant of M – L systems Fe(III)–Sulphosalicylic acid, magnetic susceptibility (χ_g and χ_m) of mercury tetracyanato cobalt or Fe(acac) and magnetic susceptibility (χ_g and χ_m) of mercury tetracyanato cobalt or Fe(acac).
			CO6	Calculate the quantity from observation of the experiments and Interpret the result obtained respective experiments.
M.Sc. I	CHE-556,	Organic Chemistry Practical II	CO1	Understand the theoretical concepts behind organic synthesis
		(Single stage preparations with spectral analysis and Two stage preparations)	CO2	Acquire the experimental skills for separation, purification, identification and synthesis of organic compounds..
			CO3	Perform thin layer chromatography. Design experimental set up for performing the organic reactions
			CO4	Monitor the organic reactions and analyse the products using spectral results.

			CO5	Describe the mechanistic aspects of organic reactions.
			CO6	Develop problem solving ability..
M.Sc. I	CHE-557 (C)	Green Chemistry	CO1	Apply the principles of green chemistry to chemical processes.
			CO2	Apply the principles of green chemistry to reduce the cost of chemical processes
			CO3	Develop economical synthetic route involving principles of green chemistry.
			CO4	Analyze chemical data and choose safer and renewable raw materials for chemical processes.
			CO5	Develop processes in accordance with Sustainable Development Goals.