ACHARYA INSTITUTE OF GRADUATE STUDIES

(NAAC Reaccredited 'A+' and Affiliated to Bengaluru City University)

Soladevanahalli, Bengaluru-560107

PROGRAM STRUCTURE FOR MASTER OF CHEMISTRY (MSc)

(With effect from the academic year 2025-26)

MSc – I SEMESTER

Sl. No	Paper	Title of the paper	Instruction Hrs per Week	No. of Credits	Duration of the Exam.	Marks		
						Internal Assessment	Semester end exam.	Total Marks
1	Ch-101	Inorganic chemistry-I	4	4	3 Hrs	30	70	100
2	Ch-102	Organic chemistry-I	4	4	3 Hrs	30	70	100
3	Ch-103	Physical Chemistry-I	4	4	3 Hrs	30	70	100
4	Ch-104	Analytical Chemistry	4	4	3 Hrs	30	70	100
5	Ch-105	Mathematics for Chemistrs	3	2	3 Hrs	30	70	100
6	CP-106	Inorganic chemistry practicals-I	4	2	4 Hrs	15	35	50
7	CP-107	Inorganic chemistry practicals-II	4	2	4 Hrs	15	35	50
8	CP-108	Physical chemistry practicals-I	4	2	4 Hrs	15	35	50
9	CP-109	Physical chemistry practicals-II	4	2	4 Hrs	15	35	50
		Total	35	26				700

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MSc – II SEMESTER

Sl. No	Paper	Title of the paper	Instruction Hrs per Week	No. of Credits	Duration of the Exam.	Marks		
						Internal Assessment	Semester end exam.	Total Marks
1	Ch-201	Inorganic chemistry-II	4	4	3 Hrs	30	70	100
2	Ch-202	Organic chemistry-II	4	4	3 Hrs	30	70	100
3	Ch-203	Physical Chemistry-II	4	4	3 Hrs	30	70	100
4	Ch-204	Molecular Spectroscopy	4	4	3 Hrs	30	70	100
5	Ch-205	Photochemistry	3	2	3 Hrs	30	70	100
6	CP-206	Inorganic chemistry practicals-III	4	2	4 Hrs	15	35	50
7	CP-207	Inorganic chemistry practicals-IV	4	2	4 Hrs	15	35	50
8	CP-208	Physical chemistry practicals-III	4	2	4 Hrs	15	35	50
9	CP-209	Physical chemistry practicals-IV	4	2	4 Hrs	15	35	50
		Total	35	26				700

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MSc – III SEMESTER

Sl. No	Paper	Title of the paper	Instruction Hrs per Week	No. of Credits	Duration of the Exam.	Marks		
						Internal Assessment	Semester end exam.	Total Marks
1	Ch-301	Organic Reaction Mechanisms	4	4	3 Hrs	30	70	100
2	Ch-302	Organic Synthesis	4	4	3 Hrs	30	70	100
3	Ch-303	Organic Spectroscopy	4	4	3 Hrs	30	70	100
4	CP -305	Organic chemistry practicals-I	4	2	4 Hrs	15	35	50
5	CP -306	Organic chemistry practicals-II	4	2	4 Hrs	15	35	50
6	CP-307	Organic chemistry practicals-III	4	2	4 Hrs	15	35	50
7	CP-308	Organic chemistry practicals-IV	4	2	4 Hrs	15	35	50
		Total	28	20				500

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MSc – IV SEMESTER

Sl. No	Paper	Title of the paper	Instruction Hrs per Week	No. of Credits	Duration of the Exam.	Marks		
						Internal Assessment	Semester end exam.	Total Marks
1	Ch-401	Stereochemistry and retrosynthetic analysis	4	4	3 Hrs	30	70	100
2	Ch-402	Chemistry of Natural Products	4	4	3 Hrs	30	70	100
3	Ch-403	Industrial Organic Chemistry	4	4	3 Hrs	30	70	100
4	Ch-404	Medicinal Organic Chemistry	4	4	3 Hrs	30	70	100
5	CP-405	Preparation of Industrially Important compounds	4	2	4 Hrs	15	35	50
6	CP-406	Extraction and Separations	4	2	4 Hrs	15	35	50
7	CP-407	Instrumental Methods and Quantitative Analysis	4	2	4 Hrs	15	35	50
8	CP-408	Qualitative Analysis of binary mixtures	4	2	4 Hrs	15	35	50
		Total	32	24				600

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NAME OF THE PROGRAM: **MASTER OF SCIENCE, CHEMISTRY**

COURSE OUTCOMES (CO'S)

M.Sc.: I Semester

SUBJECT NAME: CH 101: INORGANIC CHEMISTRY – I

After the completion of the Course, the students will be able to:

CO1: Explain and apply advanced concepts of chemical bonding including VSEPR theory, hybridization, electronegativity scales, lattice energy, and bonding models to predict molecular geometry and stability of inorganic compounds.

CO2: Analyze structures and bonding in main group compounds, boranes, carboranes, silicates, phosphazenes, and related cluster compounds using Wade's rules, MO theory, and electron-counting principles.

CO3: Evaluate acid–base behavior using HSAB theory, non-aqueous solvent systems, and polyoxometalates, and correlate these concepts with reactivity, stability, and applications.

CO4: Interpret electronic, magnetic, and nuclear phenomena including metal clusters, radioactive decay processes, and nuclear models, applying theoretical principles to inorganic and nuclear chemistry problems.

SUBJECT NAME: CH 102 - ORGANIC CHEMISTRY – I

After the completion of the Course, the students will be able to:

CO1: Illustrate bonding in organic molecules.

CO2: Explain the significance of reaction intermediates in organic chemistry.

CO3: Describe the importance of stereochemistry in organic compounds.

CO4: Understand the structure and function of carbohydrates and heterocyclic compounds.

SUBJECT NAME: CH 103 - PHYSICAL CHEMISTRY – I

After the completion of the Course, the students will be able to:

CO1: Apply quantum mechanics to explain atomic and molecular structures.

CO2: Interpret the principles of quantum mechanics and its models.

CO3: Analyze reaction kinetics, including theories of fast reactions.

CO4: Design kinetic models for homogeneous catalysis and surface chemistry.

SUBJECT NAME: **CH 104: ANALYTICAL CHEMISTRY – I**

After the completion of the Course, the students will be able to:

CO1: Demonstrate knowledge of laboratory safety practices, chemical handling, error analysis, and statistical treatment of analytical data to ensure accuracy and precision in chemical measurements.

CO2: Apply classical quantitative analytical methods such as titrimetry and gravimetry to determine the composition of chemical samples with appropriate selection of indicators, reagents, and conditions.

CO3: Explain the principles of instrumental analytical techniques based on electromagnetic radiation, including Beer–Lambert's law, spectrophotometric instrumentation, calibration methods, and detection limits.

CO4: Evaluate and apply separation techniques such as solvent extraction and chromatography (TLC, GC, HPLC) by analyzing factors affecting efficiency, resolution, and quantitative performance.

SUBJECT NAME: **CH 105 - MATHEMATICAL CONCEPTS FOR CHEMISTS**

After the completion of the Course, the students will be able to:

CO1: Solve linear equations and algebraic expressions.

CO2: Apply mathematical techniques in chemistry, including integrals for geometric and physical applications.

CO3: Solve differential equations in the context of chemical kinetics, access the accuracy and precision of measurements

M.Sc.: II Semester

SUBJECT NAME: CH 201: INORGANIC CHEMISTRY – II

After the completion of the Course, the students will be able to:

CO1: Explain metal–ligand equilibria, stability constants, and factors influencing complex formation using thermodynamic and kinetic principles and experimental determination methods.

CO2: Analyze coordination compounds using crystal field theory, molecular orbital theory, and angular overlap model to interpret geometry, electronic structure, colour, and magnetic properties.

CO3: Interpret electronic spectra of coordination complexes using Orgel and Tanabe–Sugano diagrams, and evaluate charge transfer processes and spectral properties of lanthanide and actinide complexes.

CO4: Assess magnetic and photochemical behavior of transition metal complexes, including spin crossover, exchange interactions, and photochemical reaction mechanisms relevant to inorganic systems.

SUBJECT NAME: CH 202 - ORGANIC CHEMISTRY – II

After the completion of the Course, the students will be able to:

CO1: Understand bonding in organic compounds.

CO2: Explain reaction mechanisms in substitution, addition, and elimination reactions.

CO3: Analyze rearrangement reactions and their mechanistic pathways.

CO4: Study vitamins and amino acids, their classification, and biological significance.

SUBJECT NAME: CH 203 - PHYSICAL CHEMISTRY – II

After the completion of the Course, the students will be able to:

CO1: Apply thermodynamic and statistical concepts to chemical systems.

CO2: Explain equilibrium and non-equilibrium thermodynamics.

CO3: Analyze electrochemical properties of solutions.

CO4: Apply electrochemistry concepts in real-world applications

SUBJECT NAME: CH 204: MOLECULAR SPECTROSCOPY – I

After the completion of the Course, the students will be able to:

CO1: Explain the interaction of electromagnetic radiation with matter and apply fundamental principles governing molecular energy levels and spectroscopic transitions.

CO2: Interpret rotational and vibrational spectra of molecules to determine molecular structure, force constants, and bonding characteristics.

CO3: Analyze electronic spectra and apply selection rules, transition probabilities, and spectral parameters to molecular and coordination compounds.

CO4: Correlate spectroscopic data from different techniques to solve structural and analytical problems in chemistry with scientific accuracy.

SUBJECT NAME: CH 205 - PHOTOCHEMISTRY

After the completion of the Course, the students will be able to:

CO1: Understand fundamental photochemical principles, laws, and excited-state chemistry.

CO2: Analyze photochemical reactions and emission spectra.

CO3: Study photosensitized reactions, photodegradation, and photovoltaic effects.

SUBJECT NAME: CH 301 - ORGANIC REACTION MECHANISMS

After the completion of the Course, the students will be able to:

CO1: Explain the fundamental principles of aliphatic substitution reactions, explain the mechanism of its.

CO2: Describe reactivity and mechanism of photochemical reactions

CO3: Analyse molecular orbital symmetry, Frontier molecular approach concepts and discuss the pericyclic reactions.

CO4: Discuss the free radicals' reactions, and its mechanisms and explain the role of coenzymes in the in biochemical mechanism

SUBJECT NAME: CH 302 - ORGANIC SYNTHESIS

After the completion of the Course, the students will be able to:

CO1: To acquire the knowledge of named organic reactions in C-C and C-N bond-forming reactions.

CO2: Describe the preparation and applications of the organic reagents in organic synthesis and Functional group transformation.

CO3: Discuss oxidizing agents and reducing agents in organic synthesis.

CO4: Utilize the principles of enantioselectivity and diastereoselective in asymmetric synthesis.

SUBJECT NAME: CH 303 - ORGANIC SPECTROSCOPY

After the completion of the Course, the students will be able to:

CO1: Enumerate the theory, principle and applications of Ultraviolet-visible and Vibrational (IR) spectroscopy.

CO2: Understand the principle and applications of Nuclear magnetic resonance spectroscopy.

CO3: Understand the principle of mass spectrometry and its applications.

CO4: Interpret the spectroscopic data for structure determination of unknown organic compounds.

SUBJECT NAME: CH 401 - STEREOCHEMISTRY AND RETROSYNTHETIC ANALYSIS

After the completion of the Course, the students will be able to:

CO1: Explain the fundamental principles of aliphatic substitution reactions, explain the mechanism of its.

CO2: Describe reactivity and mechanism of photochemical reactions

CO3: Analyse molecular orbital symmetry, Frontier molecular approach concepts and discuss the pericyclic reactions.

CO4: Discuss the free radicals' reactions, and its mechanisms and explain the role of coenzymes in the in biochemical mechanism

SUBJECT NAME: CH 402 - CHEMISTRY OF NATURAL PRODUCTS

After the completion of the Course, the students will be able to:

CO1: Discuss the classes, methods of isolation, stereochemistry, structural elucidation of terpenoids, and Sketch the synthesis and biosynthesis of terpenoids

CO2: Identify the classes, discuss the methods of isolation, stereochemistry, and structural elucidation of Alkaloids and sketch the synthesis and biosynthesis of alkaloids

CO3: Elucidate the structure of Porphyrins and Nucleic acids and sketch the synthesis of its

CO4: Explain the classes, biological role, stereochemistry, structural elucidation of prostaglandins and sketch the synthesis, biosynthesis of prostaglandins and insect pheromones

SUBJECT NAME: CH 403 - INDUSTRIAL ORGANIC CHEMISTRY

After the completion of the Course, the students will be able to:

CO1: Describe the methods of applying dye to fabric and Sketch the synthesis and application of dyes

CO2: Discus the classification, chemical properties, synthesis and mechanism of heterocyclic and mesoionic compounds

CO3: Recognize the typical organometallic reagent, explain their utility in organic synthesis and interpret its mechanism

CO4: Discuss the nomenclature, properties, stereochemistry, techniques of polyrnerization. Processing techniques, spinning and sketch the synthesis and applications of polymers.

SUBJECT NAME: CH 404 - MEDICINAL ORGANIC CHEMISTRY

After the completion of the Course, the students will be able to:

CO1: Use QSAR and computational techniques in drug discovery.

CO2: Analyze medicinally important organic compounds.

CO3: Apply synthetic strategies in pharmaceutical chemistry.

CO4: Design commercial synthetic routes for drug molecules.