SARDAR PATEL UNIVERSITY

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

Vallabh Vidyanagar

Gujarat

Academic Program Structure

&

Curriculum

(Aligned with NEP-2020)

M.Sc. Chemistry

NHEQF Level: 6.0/6.5

Entry NHEQF Level	:	5.5/6
Duration	:	Two Years (Four Semesters)
Total Courses	:	12+(12x5)*
Total Learning Hours	:	2640
Total Credits	:	88
Total Marks	:	2200

*Semesters **III** and **IV** will be run in five specialized subjects:
Inorganic, Organic, Physical, Analytical, and Polymer Chemistry separately

Graduate Attributes (GAs):

GAs: Upon successful completion of the program, graduates are expected to attain the

following Graduate Attributes:

GA1. Advanced Knowledge of Quantum, Retrosynthetic, and Macromolecular Chemistry

Demonstrate a profound understanding of quantum mechanical principles of chemistry, the disconnection approach for designing novel synthetic routes for organic compounds, and the structural chemistry of complex macromolecules (polymers, polysaccharides, and proteins).

GA2. Advanced Benchwork, Chemical Synthesis, and Laboratory Pedagogy

Mastery of sophisticated laboratory processes, including the synthesis of specialized compounds (dyes, pigments, inorganic materials), separation of complex ternary mixtures, and the ability to mentor learners in experimental methodologies.

GA3. Protocol Validation and Chemometrics Assessment

Expertise in validating analytical methods (GMP standards) using statistical tools (mean, hypothesis testing) and assessing the mechanical and viscoelastic behavior of materials (elasticity, glass transition, and dielectric properties).

GA4. Surface Phenomena, Kinetics, and Macromolecular Research Inquiry

Ability to analyze surface adsorption, catalytic processes, and reaction mechanisms alongside the investigation of polymer structure-property relationships and chemical kinetics.

GA5. Functional Group, Morphological Analysis & Mechanistic Logical Reasoning

Competence in identifying organic structures and isomers through spectroscopic data and characterizing material morphology using advanced microscopy (SEM, STM, AFM) to deduce chemical behavior.

GA6. Computational Modeling and Hyphenated Instrumental Proficiency

Proficiency in using software tools for molecular modeling and simulation, alongside the operation of integrated instruments such as GC-MS, LC-MS, and advanced electrochemical systems.

GA7. Scholarly Chemical Communication and Technical Dissemination

Ability to communicate complex scientific data, research findings, and technical reports clearly and concisely through oral presentations, dissertations, and peer-reviewed publications.

GA8. GLP Standards, Chemical Safety, and Macromolecular Integrity

Adherence to Good Laboratory Practices (GLP), industrial safety, and hygiene standards while ensuring the stability and integrity of synthesized inorganic, organic, and polymer materials.

GA9. Global Scientific Inclusion and Multicultural Lab Collaboration

Preparedness to work in diverse research environments, integrating global scientific trends and collaborating across international standards in R and the pharmaceutical sectors.

GA10. Cross-Disciplinary Teamwork and Industrial Engagement

Ability to work effectively in multi-disciplinary teams, bridging the gap between core chemistry and industrial applications in plastics, energy, and materials science.

GA11. Lab Leadership and Advanced Instrumentation Infrastructure Management

Capability to independently manage, operate, and maintain high-end analytical infrastructure like AAS, ICP, NMR, and thermal analysis tools (DSC, TGA) in a professional lab setting.

GA12. Supramolecular Trends and Lifelong Technological Adaptation

Commitment to continuous learning regarding emerging trends in supramolecular chemistry, photo-inorganic behavior, and adapting to rapid advancements in chemical technology.

GA13. Analytical Autonomy & Stoichiometric Accountability

The capacity to independently design experiments, perform precise quantitative analysis, and take responsibility for the accuracy of stoichiometric calculations and data interpretation.

GA14. Green Chemistry & Sustainable Biopolymer Engineering

Application of green chemistry principles to develop eco-friendly technologies, focusing on sustainable biopolymers, waste management, and resource efficiency.

GA15. Environmental Toxicology & Community-Centric Applied Chemistry

Expertise in monitoring environmental pollutants (air, water, soil) and applying chemical knowledge to solve societal issues like food safety, public health, and pharmaceutical quality control.

Program Education Outcomes (PEOs):

PEOs: Within 3–5 years of completing the program, graduates will be able to:

PEO 1. Demonstrate successful careers in academia, research, or the chemical industries by applying theoretical and practical knowledge of chemistry.

PEO 2. Operate diverse chemical industries (pharmaceutical, polymer, analytical, and materials) by applying integrated theoretical and practical expertise in chemistry,

PEO 3. Solve complex chemical problems through scientifically and innovatively inquiring into the design and executing research using a multidisciplinary approach that spans synthetic, characterization, and computational methodologies.

PEO 4. Demonstrate proficiency in utilizing sophisticated instruments aimed at exploring new chemical systems and interpreting data with high scientific rigor and accuracy.

PEO 5. Pursue higher studies, such as a Ph.D. and beyond, or specialized certifications, maintaining the adaptability required to master emerging technologies and evolving trends in the global chemical landscape

PEO 6. Uphold professional ethics and safety standards, specifically focusing on the environmental impact of plastics and the advancement of circular economy principles through recycling and waste management

PEO 7. Apply critical thinking and scientific reasoning to optimize industrial polymer processing and manufacturing, ensuring efficiency and material performance in societal applications.

PEO 8. Demonstrate awareness of global trends and cultural diversity in the context of chemical sciences and their societal impact.

PEO 9. Exhibit entrepreneurial thinking and initiative in addressing challenges and opportunities in the chemical industry.

PEO 10. Apply critical thinking to optimize industrial polymer processing, manufacturing efficiency, and material performance.

PEO 11. Uphold ethical practices, promote environmental sustainability, and commit to lifelong learning to adapt to scientific advancements.

Program Learning Outcomes (PLOs):

PLOs: Upon successful completion of the program, learners will be able to

PLO 1. Demonstrate advanced knowledge in core areas of chemistry—such as chemical thermodynamics, quantum chemistry, organic spectroscopy, bio-inorganic chemistry, and molecular mechanics—and apply analytical and computational skills to solve complex chemical problems.

PLO 2. Design, conduct, and interpret experiments using modern instrumentation, critically analyze data, and contribute original research in academic, industrial, or interdisciplinary settings.

PLO 3. Apply advanced concepts and problem-solving strategies in organic, inorganic, and physical chemistry, including reaction mechanisms, retrosynthetic analysis, and structure elucidation.

PLO 4. Effectively communicate scientific ideas, research findings, and technical information through oral presentations, technical writing, and digital media to both specialist and non-specialist audiences.

PLO 5. Collaborate productively in multidisciplinary teams, demonstrating leadership, initiative, and interpersonal skills in both academic and professional environments.

PLO 6. Utilize digital resources, computational tools, and chemical databases for research, problem-solving, and scientific documentation.

PLO 7. Uphold professional ethics, ensure laboratory safety, and demonstrate responsibility in environmental stewardship and sustainable practices.

PLO 8. Exhibit critical thinking, innovation, and adaptability to address emerging challenges and opportunities in chemical sciences and related industries.

PLO 9. Pursue lifelong learning, staying updated with advancements in science and technology, and adapting to evolving research and professional landscapes.

PLO 10. Recognize and address societal, global, and cultural contexts of chemical sciences, promoting environmental sustainability and responsible citizenship.

Program Specific Learning Outcomes (PSLOs):

PSOs (For Specialization: Inorganic Chemistry)

PSO 1. Demonstrate advanced understanding of coordination chemistry, organometallics, solid-state chemistry, and bioinorganic systems.

PSO 2. Synthesize, characterize, and analyze inorganic compounds using modern spectroscopic and analytical techniques.

PSOs (For Specialization: Organic Chemistry)

PSO 1. Design and optimize synthetic pathways and retrosynthetic strategies using modern methodologies.
interpret and correlate spectroscopic data (UV, IR, NMR, MS) for advanced structural elucidation.

PSOs (For Specialization: Physical Chemistry)

PSO 1. Apply concepts of thermodynamics, quantum chemistry, kinetics, and spectroscopy to elucidate chemical phenomena.

PSO 2. Utilize mathematical, computational, and statistical methods to model and solve physical chemistry problems.

PSOs (For Specialization: Polymer Chemistry)

PSO 1. Design, develop, and modify polymers for targeted applications in industry, medicine, and the environment.

PSO 2. Evaluate the sustainability, recyclability, and environmental impact of polymers, advocating for green chemistry in polymer science.

PSOs (For Specialization: Analytical Chemistry)

PSO 1. Apply advanced spectroscopic, chromatographic, and electroanalytical techniques for qualitative and quantitative chemical analysis.

PSO 1. Design, execute, and optimize experiments for the analysis of complex samples in environmental, pharmaceutical, and industrial contexts.

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NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

M.Sc. Chemistry

Semester-I

Course Type	Course Code	Course Title	Teaching-Learning Scheme		Credits	Assessment Scheme & Marks				
			L-P-T	Total Notional Hours		Internal Assessment			External Assessment	Total Marks
						FA	SA	Total		
DSC	**P2S01NCCHE01**	Inorganic Chemistry-I	4-0-1	8	4	30	20	50	50	100
DSC	**P2S01NCCHE02**	Organic Chemistry-I	4-0-1	8	4	30	20	50	50	100
DSC	**P2S01NCCHE03**	Physical Chemistry-I	4-0-1	8	4	30	20	50	50	100
SKILL	**P2S01NSCHE01**	Polymer Chemistry	2-0-0	4	2	15	10	25	25	50
DSC	**P2S01NCCHE04**	Chemistry Practical-I	0-8-0	8	4	20	30	50	50	100
DSC	**P2S01NCCHE05**	Chemistry Practical-II	0-8-0	8	4	20	30	50	50	100
				660	**22**	**110**	**165**	**275**	**275**	**550**

Note: Add/Remove rows as per requirement.

DSC: Discipline Specific Core **DSE**: Discipline Specific Elective **L**: Lecture **P**: Practical **T**: Tutorial **FA:** Formative Assessment **SA**: Summative Assessment

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Semester-II

Course Type	Course Code	Course Title	Teaching-Learning Scheme		Credits	Assessment Scheme & Marks				
			L-P-T	Total Notional Hours		Internal Assessment			External Assessment	Total Marks
						FA	SA	Total		
DSC	**P2S02NCCHE01**	Inorganic Chemistry-II	4-0-1	8	4	30	20	50	50	100
DSC	**P2S02NCCHE02**	Organic Chemistry-II	4-0-1	8	4	30	20	50	50	100
DSC	**P2S02NCCHE03**	Physical Chemistry-II	4-0-1	8	4	30	20	50	50	100
SKILL	**P2S02NSCHE01**	Analytical Chemistry	2-0-0	4	2	15	10	25	25	50
DSC	**P2S02NCCHE04**	Chemistry Practical-III	0-8-0	8	4	20	30	50	50	100
DSC	**P2S02NCCHE05**	Chemistry Practical-IV	0-8-0	8	4	20	30	50	50	100
				660	**22**	**110**	**165**	**275**	**275**	**550**

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