# M.Sc. Chemistry (Nanoscience) - 2022- 2023 AY & 2023-2024 AY

| Name of the course | Course code | Year of introduction | Activities/content with direct bearing on employability/ entrepreneurship/ skill development |
|---|---|---|---|
| Conceptual Organic Chemistry | NSC1C 01 | 2022 | Understanding of fundamental concepts and principles in organic chemistry. Applications of heterocyclic compounds. Principles of supramolecular chemistry and green chemistry. |
| Chemistry of Transition Metals | NSC1C 02 | 2022 | Structure, spectroscopic characterization, reaction mechanism and photochemistry of inorganic complexes. |
| Kinetics, Photochemistry and Catalysis | NSC1C 03 | 2022 | Evaluate kinetics of general chemical reactions and photochemical reactions. |
| Quantum Mechanics -I | NSC1C 04 | 2022 | Fundamental concepts and basic principles of quantum mechanics. |
| Physics and Chemistry of Solids | NSC1C 05 | 2022 | Knowledge in structure, property and applications of various crystalline and solid state materials. |
| Practical-I | NSC1P 01 | 2022 | Practical knowledge in multistep synthesis and purification of organic molecules. Apply various procedures and techniques for inorganic and physical chemistry experiments. |
| Ability Enhancement Course (AEC) | NSC1A 01 | 2022 | Develop research aptitude and skills in effective communication |
| Organic Reactions and Rearrangements | NSC2C 06 | 2022 | Write mechanism for organic reactions. Understanding multistep organic synthesis. Knowledge in pericyclic reactions and photochemistry. |
| Thermodynamics and Electrochemistry | NSC2C 07 | 2022 | Concepts of statistical mechanics, thermodynamics and electrochemistry. Applications of analytical methods in electrochemistry. |
| Quantum Mechanics -II | NSC2C 08 | 2022 | Evaluate multi-electron systems using quantum mechanics. |

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| | | | Applications of group theory in spectroscopy and chemical Bonding. |
| Introduction to Nanomaterials | NSC2C 09 | 2022 | Structure and properties of various nanostructures. Familiarize with advanced analytical tools. Understanding of methods of fabrication and growth kinetics. |
| Spectroscopy | NSC2C 10 | 2022 | Fundamental concepts and principles in molecular spectroscopy. Elucidate structures of organic and inorganic molecules using spectroscopic data. |
| Practical – II | NSC2P 02 | 2022 | Practical knowledge in synthesis and spectroscopic characterization of inorganic complexes. Apply various procedures and techniques for physical chemistry experiments. |
| Professional Competency Course (PCC) | NSC2A 02 | 2022 | Develop skills in scientific writing. Understand ethics in research and technology transfer. |
| Organometallic and Bioinorganic Chemistry | NSC3C 11 | 2022 | Structure, property and applications of organometallic compounds and clusters. Understanding the role of metal ions in biological functions. |
| Advanced Analytical Techniques | NSC3C 12 | 2022 | Working principle and instrumentation of various instruments used for the characterization of nanomaterials. Analyze experimental data obtained from different instrumentation techniques. |
| Design, Synthesis and Properties of Nanomaterials | NSC3C 13 | 2022 | Design experiments for the preparation and property tuning of various nanomaterials. Evaluate the structure-property relationship of nanomaterials. |
| Computational Nanotechnology | NSC3C 14 | 2022 | Familiarize with simulations and modelling using computational tools. Building up of z-matrix |
| Practical-III | NSC3P 03 | 2022 | Develop practical skills on synthetic approaches for |

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| | | | Nanomaterials. Hands on experience on using various sophisticated instruments, data collection and analysis. |
| Project | NSC4PR 01 | 2022 | Skills in literature survey, designing research problem and experiments, data collection and interpretation, publishing research papers. |
| Nanostructured Solar Cells | NSC4E 01 | 2022 | Design potential nanomaterials and device architectures for efficient energy production. |
| Nanomaterials for Photo-catalysis and Solar Fuel Generation | NSC4E 02 | 2022 | Develop efficient nanostructured photocatalysts for various applications. |
| Micro/Nano Electro-mechanical Systems (MEMS/NEMS) | NSC4E 03 | 2022 | Fabrication methods, characterization and applications of MEMS/NEMS |
| Sustainable Nanomaterials | NSC4E 04 | 2022 | Recognize environmental impacts of nanomaterials. Develop green methods for synthesis and applications of nanomaterials. |
| Nanomaterials for Supercapacitor Applications | NSC4E 05 | 2022 | Design novel nanomaterials and device architectures for supercapacitor applications. Knowledge in material and device characterization. |
| Computational Studies on Bioactive Compounds | NSC4E 06 | 2022 | Understand and apply various computational tools in studying bioactive compounds. |
| Precision Nanoclusters: Origin and Applications | NSC4E 07 | 2022 | Knowledge in structure, property, synthesis and characterization of precision nanoclusters. Design and develop promising nanoclusters for potential applications. |
| Materials in Medicine | NSC4E 08 | 2022 | Knowledge in nanomaterials used for biomedical applications. Evaluate and recognize potential nano-biomaterials for specific applications. |

# M.Sc. Chemistry (Nanoscience) - 2024-2025 AY onwards

| Name of the course | Course code | Year of introduction | Activities/content with direct bearing on employability/ entrepreneurship/ skill development |
|---|---|---|---|
| Conceptual Organic Chemistry | NSC7C 501 | 2024 | Understanding of fundamental concepts and reaction mechanism in organic chemistry. Applications of heterocyclic compounds. Practical knowledge in purification of organic molecules. |
| Chemistry of Transition Metals | NSC7C 502 | 2024 | Structure, spectroscopic characterization, reaction mechanism and photochemistry of inorganic complexes. Practical knowledge in synthesis and spectroscopic characterization of inorganic complexes. |
| Kinetics, Photochemistry and Catalysis | NSC7C 503 | 2024 | Evaluate kinetics of general chemical reactions and photochemical reactions. Apply various procedures and techniques for physical chemistry experiments. |
| Physics and Chemistry of Solids | NSC7E 501 | 2024 | Knowledge in structure, property and applications of various crystalline and solid state materials. |
| Thermodynamics and Surface Chemistry | NSC7E 502 | 2024 | Concepts of statistical mechanics, thermodynamics and Colloidal systems. |
| Surface Energy and Growth Kinetics of Nanomaterials | NSC7E 503 | 2024 | Structure and properties of various nanostructures. Familiarize with advanced analytical tools. Understanding of methods of fabrication and growth kinetics. |
| Structure and Properties of Materials | NSC7E 504 | 2024 | Fundamental principles, properties, phase transformations and applications of materials. |
| Nanomaterials for Energy Production and Storage | NSC7E 505 | 2024 | Knowledge in applications of nanomaterials for energy production and storage. Emerging |

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| | | | trends and research opportunities in nanomaterials for energy |
| MOOC -I | NSC7M 501 | 2024 | |
| Organic Reactions and Rearrangements | NSC8C 504 | 2024 | Write mechanism for organic reactions. Understanding multistep organic synthesis. Knowledge in pericyclic reactions and photochemistry. Practical knowledge in multistep synthesis |
| Advanced Electrochemistry | NSC8C 505 | 2024 | Fundamental principles in electrochemistry. Applications of analytical methods in electrochemistry. Practical knowledge in electrochemistry experiments. |
| Quantum Mechanics -I | NSC8C 506 | 2024 | Fundamental concepts and basic principles of quantum mechanics. |
| Precision Nanoclusters: Origin and Applications | NSC8E 506 | 2024 | Knowledge in structure, property, synthesis and characterization of precision nanoclusters. Design and develop promising nanoclusters for potential applications. |
| Nanostructured Solar Cells | NSC8E 507 | 2024 | Design potential nanomaterials and device architectures for efficient energy production. |
| MOOC -II | NSC8M 502 | 2024 | |
| Organometallic Chemistry, Bio-Inorganic Chemistry, and Applications of Spectroscopy | NSC9C 601 | 2024 | Structure, property and applications of organometallic compounds and clusters. Understanding the role of metal ions in biological functions. Elucidate structures of organic and inorganic molecules using spectroscopic data. |
| Quantum Mechanics -II | NSC9C 602 | 2024 | Evaluate multi-electron systems using quantum mechanics. Applications of group theory in spectroscopy and chemical Bonding. |
| Molecular Spectroscopy | NSC9C 603 | 2024 | Fundamental concepts and principles in molecular spectroscopy. |
| Advanced Analytical Techniques | NSC9E 601 | 2024 | Working principle and instrumentation of various instruments used for the |

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| | | | characterization of nanomaterials. Analyze experimental data obtained from different instrumentation techniques. |
| Micro/Nano Electromechanical Systems (MEMS/NEMS) | NSC9E 602 | 2024 | Fabrication methods, characterization and applications of MEMS/NEMS |
| Computational Nanotechnology | NSC9E 603 | 2024 | Familiarize with simulations and modelling using computational tools. Building up of z-matrix |
| Design, Synthesis and Properties of Nanomaterials | NSC9E 604 | 2024 | Design experiments for the preparation and property tuning of various nanomaterials. Evaluate the structure-property relationship of nanomaterials. |
| Project | NSC10P 601 | 2024 | Skills in literature survey, designing research problem and experiments, data collection and interpretation, publishing research papers. |
| MOOC -III | NSC10M 601 | 2024 | |
| Bio-Nanomaterials | NSC10C 604 | 2024 | Knowledge in nanomaterials used for biomedical applications. Evaluate and recognize potential nano-biomaterials for specific applications. |
| Advanced Nanomaterials | NSC10C 605 | 2024 | Structure, properties and applications of advanced nanomaterials. |
| Nanostructured Super Capacitors | NSC10C 606 | 2024 | Design novel nanomaterials and device architectures for supercapacitor applications. Knowledge in material and device characterization. |
| Nanomaterials for Sustainable Technology | NSC10C 607 | 2024 | Recognize environmental impacts of nanomaterials. Develop green methods for synthesis and applications of nanomaterials. |
| Computational Studies on Bio-active Compounds | NSC10C 608 | 2024 | Understand and apply various computational tools in studying bioactive compounds. |