

MSc in Chemical Sciences and Instrumentation Curriculum

Trimester 1	Trimester 2	Trimester 3
3 Aug 26 to 30 Oct 26	9 Nov 26 to 19 Feb 27	1 Mar 27 to 28 May 26

You may refer to this [link](#) for more information on the academic calendar.

Core			
Course Code	Course title	Trimester	Academic Unit (AU)
CM6800	Critical Evaluation of Chemistry Research	1	4
CM6801	Academic Communication	1	0
CM6810	Advanced Chemical Instrumentation	1	2
TP6202	Technology Commercialisation	1	3

Prescribed Electives			
Synthesis and Life Sciences Specialization			
Course Code	Course title	Trimester	Academic Unit (AU)
CM6820	Graduate Basic and Technical Inorganic Chemistry	2	2
CM6832	Drug Discovery and Development	2	4
CM6850	Graduate Chemical Biology	3	4
CM6831	Graduate Life Science Organic Chemistry	2	2

Prescribed Electives			
Analytical and Nanotechnology Specialization			
Course Code	Course title	Trimester	Academic Unit (AU)
CM6840	Advanced Analytical and Spectroscopic Methods in Materials Chemistry	2	2
CM6841	Advanced Synthetic and Physical Approaches to Materials Chemistry	2	2

CM6842	Application of Artificial Intelligence in the Chemical Sciences	3	3
CM6860	Advanced Nanoscience and Nanotechnology	2	3
CM6812	Analytical Chemistry in Industry	3	2

Unrestricted Electives			
Course Code	Course title	Trimester	Academic Unit (AU)
CM6811	Advanced Techniques for Structural Determination	3	3
CM6835	Recent Trends in Organic Synthesis	3	3
CM6843	Computational Chemistry for Molecular Modelling	2	3
CM6844	Scientific Computing with Python	2	3
CM6861	Advanced Topics in Environmental Sciences and Sustainable Development	3	3
CM6862	Advanced Analytical & Manufacturing Techniques in Pharmaceutical Industry	3	3
CM6865	Graduate Internship	3	3
CM6890	Research for MSc I	2, 3	6
CM6891	Research for MSc II	3	3

Core Courses

CM6800 – Critical Evaluation of Chemistry Research

This course is intended to encourage graduate students to participate in seminars and read scientific literature in the areas of synthetic, bio-organic, and bio-inorganic chemistry. The course is structured to help graduate students to improve their presentation skills.

CM6801 - Academic Communication

This course prepares master's students for the demands of academic writing and oral presentations in English. It equips them with the skills to produce a research paper for possible publication, and to deliver informative and persuasive presentations in academic settings.

CM6810 - Advanced Chemical Instrumentation

This course provides in-depth hands-on experience and skills for instruments commonly used in chemistry. In addition to hands-on training, the course includes lectures on the basic concepts and applications of the instruments, and how to troubleshoot them.

TP6202 - Technology Commercialisation

Introduction to the exploitation and commercialisation of technologies and IP. The course provides a platform to examine trends and key issues in managing the innovation process and IP creation and commercialising technological innovations in the knowledge economy. Participants need to understand the latest technological research and development and identify technology commercialisation possibilities. The course also covers the successful management and transfer of technologies from a research environment for commercialisation as successful and sustainable products or services to the global market, and the challenges and opportunities posed by emerging technologies in the Fourth Industrial Revolution.

Prescribed Electives (Synthesis and Life Sciences Specialization)

CM6820 - Graduate Basic and Technical Inorganic Chemistry

The objective of this course is to revisit some of the basic concepts and techniques in current inorganic chemistry research. It is conducted in the form of a weekly series of workshop-type discussions and reflections that are assessed. Topics covered include structure and bonding in inorganic compounds, experimental techniques in inorganic research, solution-state structures and NMR techniques, solid-state structures and X-ray crystallography, transition metal catalysis, and asymmetric catalysis.

CM6832 - Drug Discovery & Development

This course will introduce students to the drug discovery and development process, the main concepts, medicinal chemistry, the fundamental molecular bases of drug action, drug target discovery and “drugability”, structure-activity relationships, new designs and high throughput screening methods to discover new drugs and classes of drugs, and preclinical and clinical studies. There will also be some case studies on existing drug molecules. Having successfully completed this course, you will develop the necessary knowledge and skills for a career that involves medicinal chemistry for research and pharmaceutical applications in industry.

CM6850 - Graduate Chemical Biology

This course focuses on the interdisciplinary topic of chemical biology. Students will be exposed to fundamental concepts about chemical biology that will be useful for further studies in the field. The concepts will also be relevant to emerging areas in industry such as biosynthesis and genetic modifications.

CM6831 - Graduate Life Science Organic Chemistry

The objective of this course is to cultivate a mind-set of solving problems in life science with organic chemistry expertise by understanding the basic concepts and how to apply them in understanding phenomena. The topics covered include advanced reactions in boron chemistry, carbohydrate chemistry (representing biomolecules), and radical chemistry (representing reaction intermediates). These organic reactions will then be examined in the context of their applications in biological, biomedical, and biomaterials research.

Prescribed Electives (Analytical and Nanotechnology Specialization)

CM6840 - Advanced Analytical and Spectroscopic Methods in Materials Chemistry

This course provides advanced knowledge in analytical and spectroscopic materials chemistry. It covers the principles of analytical and spectroscopic techniques comprehensively and deeply, with a focus on recent advances and current topics in analytical and spectroscopic materials chemistry.

CM6841 - Advanced Synthetic and Physical Approaches to Materials Chemistry

This course provides advanced knowledge in synthetic and physical materials chemistry. It covers the synthetic and physical aspects of materials and reactions, with emphases on recent advances and current topics in synthetic and physical materials chemistry.

CM6842 - Applications of Artificial Intelligence in the Chemical Sciences

This course aims to equip you with working knowledge of how artificial intelligence (AI) can be applied to chemistry. As a start, you will learn the rigorous way to construct Python projects for AI. Next, you will learn how to apply AI to analyze chemical data, either for visualization, classification, quantitative determination, or for pursuing insights into chemical process. We will introduce multiple case studies and analyze how AI has impacted the various sub-disciplines of chemistry. The course will improve your communication skills by requiring you to deliver technical presentations to a broad audience. As a result of this course, you will develop the necessary skills to prepare yourself for a career that involves harnessing AI for research and industry applications.

CM6860 - Advanced Nanoscience and Nanotechnology

This course provides a platform to understand small systems, in particular materials at the nanometre length (10⁻⁹ m). It covers the multidisciplinary field of nanoscience and nanotechnology, which lies at the converging point of chemistry, materials, physics, biology, and other fields. We will study how nanoscience and nanotechnology help solving global challenges faced by mankind. Guest lecturers will be invited to introduce their latest research in nanoscience and nanotechnology.

CM6812 - Analytical Chemistry in Industry

This course covers a broad selection of advanced analytical chemistry techniques commonly employed in the energy, chemical, and semiconductor industries. The course will introduce advanced principles in analytical chemistry, advanced electrochemical methods, advanced spectroscopic methods of analysis, environmental analysis and sampling, advanced chromatography and separations, mass spectrometry detection, and surface characterisation techniques. The lectures provide an advanced account of modern analytical methods and instruments that are used to quantify chemical and biological samples and to monitor the progress of reactions.

Unrestricted Electives

CM6811 - Advanced Techniques for Structural Determination

This course focuses on two of the most commonly used modern instrumentation methods for structural determination, X-ray diffraction and nuclear magnetic resonance. It will build on basic knowledge of these methods and introduce more advanced concepts and techniques.

CM6831 - Graduate Life Science Organic Chemistry

The objective of this course is to cultivate a mind-set of solving problems in life science with organic chemistry expertise by understanding the basic concepts and how to apply them in understanding phenomena. The topics covered include advanced reactions in boron chemistry, carbohydrate chemistry (representing biomolecules), and radical chemistry (representing reaction intermediates). These organic reactions will then be examined in the context of their applications in biological, biomedical, and biomaterials research.

CM6835 - Recent Trends in Organic Synthesis

The course explores the frontiers of organic synthesis, equipping students with knowledge for careers in research and industry. It covers principles, scope and basic reactions of organic chemistry. This, synthetic route design and current topics like green chemistry. Students will enhance their communication skills through technical presentations. Key topics include the importance of organic synthesis, Nobel discoveries, green chemistry, new synthetic methods, asymmetric synthesis, natural product synthesis, chemical biology and emerging topics.

CM6843 - Computational Chemistry for Molecular Modelling

Having successfully completed this course, you will develop the necessary knowledge and skills for a career that involves computational chemistry and molecular modelling for research and applications in chemical industry. This course will introduce students to learn basic computational chemistry and its

applications with ab initio software. Students will learn how to start collaborations on performing a research project based on ab initio software in this course and they will also present their results in a scientific manner.

CM6844 - Scientific Computing with Python

This course will introduce students to Python programming and its applications in numerical simulations in the chemical sciences. Students will learn how to develop homemade computational programme to solve routine chemical problems to achieve automation. They will also learn how to present their results in a scientific manner. Having successfully completed this course, you will develop the necessary knowledge and skills for a career that involves scientific data processing and automation for research and applications in the chemical industry.

CM6861 - Advanced Topics in Environmental Sciences and Sustainable Development

This course is an inter-disciplinary and broad survey of topics related to industrial and environmental chemistry within Singapore and around the world. The topics are intended to bring greater awareness to practical applications of chemistry beyond the traditional molecular chemistry curriculum. The course will give overview of industrial and environmental chemistry, with a focus on industries relevant to Singapore's current and future chemical industry.

CM6862 - Advanced Analytical & Manufacturing Techniques in Pharmaceutical Industry

This course covers the analytical and manufacturing techniques used in drug discovery and development. Topics include the drug discovery and development process, analytical techniques (high performance liquid chromatography, liquid chromatograph mass spectrometry, gas chromatography, gas chromatograph mass spectrometry), chemistry, manufacturing & controls (CMC), continuous flow chemistry and manufacturing techniques like biocatalysis and additive manufacturing.

CM6865 - Graduate Internship

This course provides students with relevant on-the-job training at companies in Singapore. The student will start the internship after Trimester 2 in the academic year during the summer special term. The internship will be conducted in an approved chemical company or institution and can be self-source.

CM6890 - Research for MSc I

This independent research study course gives students experience in planning and executing the early stages of a research career. Students will have to actively engage and arrange for a faculty member to host them for a research project. Each student will individually work on a project. The assessments will include a project proposal due at the early stages of the trimester and a final report due at the end of the trimester. The assessments are letter-graded, but there is no final examination. Students can choose to enrol in this course in either Trimester 2 or 3.

CM6891 - Research for M.Sc. II

This independent research study course gives students more experience in planning and executing the early stages of a research career. Students will have to actively engage and arrange for a faculty member to host them for a research project. Each student will individually work on a project. The assessments will include a project proposal due at the early stages of the trimester and a final report due at the end of the trimester. The assessments will all be letter-graded, but there will be no final examination for this course. Students can enrol this course in Trimester 3, but only after passing CM6890. Students can choose to work with the same faculty member as for CM6890, or a different faculty member.

*Prerequisite: CM6890