Master of Science in the field of CHEMICAL TECHNOLOGIES for HEALTH and MATERIALS

Nurture future professionals to navigate the ever-evolving chemical industry

2024–25 (September 2024 intake)
Why this Programme

◊ A chemistry-empowered, innovative and comprehensive MSc programme that strengthens students’ knowledge to cope with ever-evolving challenges in the health and materials industries.

◊ A skill-infused interdisciplinary training opportunities with extensive hands-on experience to cater for broad academic aspirations and career developments.

Programme Information

Tuition fees
Composition fee: HK$240,000 (subject to approval)
Students are required to pay Caution Money (HK$350, refundable on graduation subject to no claims being made) and Graduation Fee (HK$350)

Programme duration
Full-time: 1.5 years

Medium of instruction
English

Study load
Credits: 72 credits
Learning hours: about 1,500-2,000 hours (including 9-month project)

Class schedule
Teaching could be on weekdays or weekday evenings, with occasional concentrated teaching during weekends

Assessment
Mostly coursework and written examination

Where will this Programme Lead You

Interdisciplinary training
By integrating the practical with the theoretical knowledge, the Master of Science in the field of Chemical Technologies for Health and Materials programme acts as a conduit for interdisciplinary training and deliver the next level of operational excellence in the chemical related industries.

Career development
Talents with a strong chemistry background, laboratory skills and an innovative mindset are highly valued by many employers in social and private sectors, particular in health and energy related industries

Host

Department of Chemistry

The Department of Chemistry at HKU is a world-class institution that offers exceptional academic programmes, state-of-the-art research facilities, and a team of dedicated Faculty members who are experts in their respective fields. Some of the most distinguished chemists include Nobel Prize laureate, members of the Chinese Academy of Sciences and foreign members of National Academy of Sciences, USA. Thanks to its rigorous and cutting-edge curriculum, the Department takes pride in nurturing successful graduates who have made significant contributions in academia, industry, and government. Striving to make a profound impact on society, the Department’s research outputs are nothing short of remarkable, having led to groundbreaking discoveries in fields such as drug discovery, optoelectronics, energy conversion and storage. With a commitment to providing students with the knowledge, skills, and practical experience needed to succeed in the fields of chemistry and chemistry-empowered industry, HKU Department of Chemistry is undoubtedly the top-tier institution in its field.
**WHAT YOU WILL LEARN**

### Design of curriculum (72 credits)

#### Core Courses (30 Credits)

- CTHM701 Advanced chemical instrumentation and data analysis (6 Credits)
- CTHM704 Frontiers in modern materials: from theory to applications (6 Credits)
- CTHM705 Innovation, technology transfer and entrepreneurship (6 Credits)
- CTHM706 Bioanalytical methods: principles and diagnostic applications (6 Credits)
- CTHM801 Research and development seminar (6 Credits)

#### Disciplinary Electives Courses (18 Credits)

- CTHM702 Synthesis for drugs and advanced materials (6 Credits)
- CTHM703 New technologies for chemical biology (6 Credits)
- CTHM707 Green and sustainable chemistry (6 Credits)
- CTHM708 Quality assurance and regulatory compliance (6 Credits)
- *CTHM709 Big data analysis in analytical science (6 Credits)
- COMP704 Computational intelligence and machine learning (6 Credits)
- *STAT807 Data mining techniques (6 Credits)
- CHEM613 Advanced materials (6 Credits)
- CHEM614 Medicinal chemistry (6 Credits)
- CTHM704 and COMP704 are non-permissible combination. Students are only permitted to take either one of these courses.

#### Capstone Requirement (24 credits)

- CTHM802 Research project and dissertation (24 Credits)

### Core Courses

**CTHM701 Advanced chemical instrumentation and data analysis**

The aim of this course is to provide students with an understanding of advanced modern chemical instrumentation, covering both fundamental principles and practical aspects of instrument design for qualitative and quantitative chemical analysis. The course emphasizes bridging theory and practice to address real-life problems. The frontiers in electrochemical technologies, mass spectrometry analysis and machine learning for chemical analysis will be discussed.

**CTHM704 Frontiers in modern materials: from theory to applications**

This course provides an in-depth exploration of modern materials chemistry, with a focus on bridging fundamentals and practical applications. The topics include functional materials and nanodevices for energy conversion and storage, environmental issues, biomedicine, and optoelectronics. The course also covers the fundamentals of materials chemistry, design strategies, synthesis, device preparation, and characterization. Throughout the course, students will learn about the latest techniques used in materials chemistry and gain hands-on experience.

**CTHM705 Innovation, technology transfer and entrepreneurship**

This course provides students exposure into how science/technology startup is conceived and established. From laboratory scientific research results to successful technology concepts and products, the students who are interested in technology transfer and entrepreneurship need to build up a spectrum of knowledge and practical experiences from technology analyses, product ideation, value evaluation, business plan, IP preparation, all the way to team building, funding raising, and go-to-market strategy. Students in this course will obtain essential understanding of how tech startup is built and triumphed, which is a key introductory step in becoming future technology transfer professionals and entrepreneurs.

**CTHM706 Bioanalytical methods: principles and diagnostic applications**

This course provides an overview of bioanalytical methods for disease diagnostics and sensing applications. Course contents cover the principles and applications of modern bioanalytical techniques. Selected topics include chemistry of MRI and contrast agents, point-of-care testing, microfluidics, mass spectrometry, next-generation DNA sequencing and other nucleic-acid-based analysis, and separation science. Other emerging technologies and the latest development in bioanalytical chemistry will also be discussed.

**CTHM801 Research and development seminar**

The course consists of a series of seminars, which are designed to acquaint students with the latest advancements and developments in chemical technologies that are relevant to health, well-being, materials synthesis, and analysis. The seminar series will cover topics such as the latest advancements in chemical technologies, new materials and their applications, synthesis and analysis techniques, biochemical processes involved in drug discovery and development, and other related topics. Students will present their literature research and findings in class and receive feedback from their peers and instructors.

### Disciplinary Elective Courses

**CTHM702 Synthesis for drugs and advanced materials**

This course provides a comprehensive training on synthetic methods that are applicable to the preparation of pharmaceuticals and organic materials. Current organic transformations, including oxidations/reductions, substitutions, enolate chemistry, and transition metal-catalyzed transformations will be covered. A focus of this course is the application of these methods in the synthesis of drugs and materials, with discussions on multiple examples in both academia and industrial manufacturing.

**CTHM703 New technologies for chemical biology**

This course covers state-of-the-art advancements in technologies to probe chemistry in cells, with a primary focus on the latest development and application of technologies for examining cellular processes, molecular interactions, and their implications in biology and medicine. The novel technologies probing cellular chemistry using chemical biology, synthetic biology, and genome engineering methodologies, as well as techniques for single-cell analysis, microscopy, and mass spectrometry analysis, will be discussed.

**CTHM707 Green and sustainable chemistry**

The principles and practices of green chemistry, focusing on renewable energy, green catalysis, and carbon neutrality will be discussed. The course covers the chemistry underlying renewable energy technologies; green catalysis in the synthesis of important chemicals, such as pharmaceuticals and polymers; and investigates the concept of carbon neutrality such as carbon capture and storage. Through a combination of lectures, readings, and case studies, students will learn about the principles and applications of green chemistry, as well as the environmental and economic benefits of this approach.

**CTHM708 Quality assurance and regulatory compliance**

A good grasp of effective practices to maintain service quality and adhere to government legislations and regulatory guidelines is vital for entering into the industry. Building upon basic metrology concepts and techniques used in quality control, this course aims to provide a thorough understanding of the principles and requirements for both management and technical aspects of the international standard ISO/IEC 17025:2017, along with other management standards such as Good Laboratory Practice (GLP) and Good Manufacturing Practice (GMP). Practical guidelines for establishing, implementing and maintaining a quality management system for laboratory operation are given. Requirements of internal and external audits as stipulated in ISO/IEC 17025:2017, and criteria from accreditation bodies such as Hong Kong Accreditation Service (HKAS) and China National Laboratory Accreditation Committee (CNAS) are also addressed. Emphasis is also given to technical requirements for different disciplines.

**CTHM709 Big data analysis in analytical science**

This course focuses on the application of big data analytics in analytical chemistry, health and materials sciences. It introduces students to the principles of big data analytics, current challenges, most recent development, and opportunities presented in the field. Case studies on big data analytics in chemistry, including the use of advanced analytics in the areas of drug discovery, diagnosis, materials development and environmental analysis will also be discussed.

**CHEM613 Medicinal chemistry**

This course covers the chemical principles of drug design and drug action. It discusses the drug discovery, design, and development; as well as drug metabolism, prodrugs and drug delivery. It serves as an introduction to the current development of biorgano/inorganics chemistry, pharmaceutical chemistry, and biotechnology.
WHAT YOU WILL LEARN

This course gives a comprehensive overview on materials chemistry. It focuses on the application of materials in advanced technology for renewable energy, catalytic devices, sustainable resource utilization, wearable biosensors, nanoelectronics, membrane technology, and other specialty applications. The most recent development, synthesis, and characterization in materials chemistry will also be discussed.

STAT8017 Data mining techniques

With the rapid developments in computer and data storage technologies, the fundamental paradigms of classical data analysis are mature for change. Data mining techniques aim at helping people to work smarter by revealing underlying structure and relationships in large amounts of data. This course takes a practical approach to introduce the new generation of data mining techniques and show how to use them to make better decisions. Topics include data preparation, feature selection, association rules, decision trees, bagging, random forests and gradient boosting, cluster analysis, neural networks, introduction to text mining.

COMP7404 Computational intelligence and machine learning

This course will teach a broad set of principles and tools that will provide the mathematical, algorithmic and philosophical framework for tackling problems using Artificial Intelligence (AI) and Machine Learning (ML). AI and ML are highly interdisciplinary fields with impact in different applications, such as, biology, robotics, language, economics, and computer science. AI is the science and engineering of making intelligent machines, especially intelligent computer programs, while ML refers to the changes in systems that perform tasks associated with AI. Ethical issues in advanced AI and how to prevent learning algorithms from acquiring morally undesirable biases will be covered.

YOUR PROGRAMME EXPERTS

**Programme Director**
Professor Zheng Xiao GUO
Chair Professor, BSc Northeastern; PhD Manchester

**Programme Coordinators**
Dr Kenneth King-Hei NG
Dr Angela Mai Yan YUEN

Other Academic Staff

Department of Chemistry
Professor Chi-Ming CHE
Professor Hongzhe SUN
Professor Vivian Wing Wah YAM
Professor Guanhua CHEN
Professor Pauline CHIU
Professor Zheng Xiao GUO
Professor Xiang David LI
Professor Xiaoyu LI
Professor Xuexin LI
Dr Ho Yu AU-YEUNG
Dr Aspen Xiao-Yang CHEN
Dr Ivan K CHU
Dr Haibo JIANG
Dr Jian HE
Dr Patrick Henry TOY
Dr Seungkyu LEE
Dr Zhongxing HUANG
Dr Jun YANG

Department of Radiology
Dr Victor LEE

**MA, MSc, PhD Cambridge**
BSc, PhD HKU

BSc, MSc CAS Wuhan; PhD London
BSc, PhD HKU
BSc, PhD Caltech
BSc, PhD Toronto
BSc Northeastern; PhD Manchester
BSc, PhD Hong Kong
BSc, PhD Chicago
BSc, MPhil CUHK; PhD Cambridge
BSc, PhD Princeton
BSc, PhD CityUHK
BSc, PhD Oxford
BSc, PhD Tokyo
BA, PhD Columbia
BSc, PhD Wayne State
BSc, MEng; PhD Hong Kong
BSc, PhD Illinois
BSc, PhD HKUST
BSc, PhD Chicago
BSc, MSc KAIST; PhD UC Berkeley
BSc, PhD Hong Kong
BSc, MD, FRCR, FHKCR, FHKAM (Radiology)

What underpins our health and industry is not just about the understanding of ‘s-p’ orbital hybridisation, but the mastery of 'Science-Practice' integration – this is what our empowering chemistry MSc programme is to offer. A future-ready chemistry MSc programme - for learners to CREATE: Critical thinking, Resourcefulness, Excellent skills set, Active learning, Technologically savvy, and Entrepreneurially spirited.
Admissions

Requirements

◊ A Bachelor’s degree in Science or Engineering
◊ Preference will be given to those specialising in related science or engineering disciplines (e.g. chemistry, biochemistry, material science, biotechnology, medical science, health science, analytical science, chemical engineering, environmental engineering, materials or mechanical engineering)
◊ Fulfil the University Entrance Requirements

How to apply

Application deadlines:
Non-local applicants: **12:00 noon (GMT +8), April 30, 2024**
Local applicants: **12:00 noon (GMT +8), June 28, 2024**

Online application:
[admissions.hku.hk/tpg](admissions.hku.hk/tpg)

Expected degree conferment will take place in

July 2026 (Summer Congregation)

Further Information

Programme details
[bit.ly/mscfchem](bit.ly/mscfchem)

Enquiries

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