Master of Science
Industrial Chemistry

At A Glance

JOINT DEGREE BY
Technische Universität München (TUM)
National University of Singapore (NUS)

18 MONTHS FULL TIME PROGRAMME
Coursework in Singapore

PRACTICAL KNOWLEDGE
Compulsory Internship & Thesis

GLOBAL PROSPECTS
Internationally Recognized Degree

INTAKE
August Every Year

TO APPLY
Apply online from 1st November at www.tum-asia.edu.sg

1 TUM is ranked as the #1 University in Germany*

11 TUM ranked #11 in the Global Employability Survey*

13 TUM has produced 13 Nobel Laureates

50 Both TUM & NUS are in the world’s Top 50 Universities
TUM Asia

TUM Asia, set up in 2002, is the first German academic venture abroad and bears a decade of experience in providing top-class German education in Singapore. Though Asian in location, the academic model employed by TUM is nevertheless German in its roots, with an emphasis on industry readiness and innovation.

Partnering with fellow top universities such as National University of Singapore (NUS) and Nanyang Technological University (NTU), TUM Asia offers stand-alone and joint Bachelor and Master programmes designed to groom the next generation of entrepreneurs and leaders. TUM Asia is recognized by the Ministry of Education Singapore as an Institute of Higher Learning and is registered with the Council of Private Education in Singapore.

Moving forward, TUM Asia strives to continue to provide Master and Bachelor programmes that are industry-focused and in tune with the needs of the global economy.

Technische Universität München (TUM)

Founded in 1868 by King Ludwig II, Technische Universität München (TUM) has long established itself as a premier institute of higher learning in Germany. Ranked as Germany’s #1 University for 3 consecutive years (ARWU 2011, 2012, 2013), TUM has maintained its reputation of being a provider of excellent academic education. Currently, TUM boasts of 13 faculties with more than 35,000 students (about 20 percent of them come from abroad), 507 professors and about 9,900 staff.

TUM’s high regard for innovation has earned itself the reputation of being an institute that produces world-changing technologies. Some notable inventions from the TUM alumni include the Refrigeration Technology created by Carl von Linde; the Dornier airplane by Claude Dornier; and the Diesel engine invented by Rudolf Diesel. To date, TUM has seen a total of 13 Nobel Prize laureates come through its ranks, including distinguished chemists and physicists such as Ernst Otto Fischer and Rudolf Mößbauer.

Known as a premier address in Europe that encourages students to pursue innovation and entrepreneurship, a TUM degree is key to unlock a world of possibilities.
Master of Science
Industrial Chemistry

TUM Asia’s Master of Science in Industrial Chemistry (MSc in IC) aims to groom future leaders in selected areas of technology. It is an enriching postgraduate course for specialist engineers in the pharmaceutical, fine & specialty chemical industries.

COURSE OUTLINE

14

The student has to complete 14 modules in 2 semesters
(5 Core Modules, 6 Elective Modules & 3 Cross Discipline Modules)

3

Specialisations to choose from: Petroleum and Petrochemistry, Biochemistry, or a Combination of 3 - 4 modules of your choice

45

Contact hours for every Core, Elective Module, and lab courses

Duration of the Programme: 18 - 19 months

August

4 Months

6 Months

2 -3 Months

6 Months

Graduation

Arrival in Singapore

- Business & Technical English
  - Core Modules
  - Lab Modules
  - Cross Discipline Modules

- Elective Modules
  - Lab Modules
  - Cross Discipline Modules

Internship

Master Thesis at NUS/TUM or a Company

End of Programme

JOINT DEGREE

Conferred by Technische Universität München (Germany) and National University of Singapore (Singapore)

3 SEMESTERS

Full-time research and application focused programme, inclusive of internship experience and Master Thesis writing

INDUSTRY RELEVANCE

Our professors are actively involved in research and cooperation projects with leading industrial companies, allowing them to base the curriculum around the latest technological trends and knowledge

GLOBAL OPPORTUNITIES

You are able to complete your Internship and Dissertation in Munich, Singapore or anywhere in the world, to look for job opportunities globally
Module Synopsis

**Core Modules** (*Comes With Practical*)
- Organo-Metallic and Coordination Chemistry*
- Bioorganic Chemistry*
- Chemical Reaction Engineering*
- Chemical Business Administration

**Area of Specialisation** (Choose One Area)

**Specialisation 1: Petroleum and Petrochemistry**

Molecular and Heterogeneous Catalysis
The goal of this module is to provide insight into the important field of catalysis. Both homogeneous and heterogeneous catalysis will be described and important applications will be exemplary described. An understanding of the principles of catalysis and the demands on efficient catalysts will be provided. The principles of establishing catalytic mechanisms will be outlined.

Petroleum and Petrochemical Processes
The scope of the course module is to enable students to understand the principal processes involved in petroleum processing, in the interface between petroleum refining and a petrochemical plant and in major petrochemical operations. This includes: Basics of crude oil chemistry, Distillation of crude oil, Catalytic conversion and upgrading processes, Thermal conversion and upgrading processes, Production and managing hydrogen, Basic Petrochemical Processes.

The course teaches the chemical and engineering basics underlying the processing options and processes. The student should be able to understand the options and limits of adjusting reaction conditions and to develop improved or alternative reaction routes. The insight into these chemical and engineering aspects should help to understand the complexity of the processes in the two areas and the options for designing the appropriate interface between a petroleum complex and the making of basic petrochemicals.

Unit Operations
The scope of the course module is to enable students to understand the principals and the applications of unit operations involved in Petroleum and Petrochemical Processes. This is aimed at providing the skills in the following fields: Thermal unit operations, Mechanical unit operations, Reactor Technology.

The course teaches the qualitative and quantitative basics engineering principles used to design and to operate mechanical, thermal, and chemical units of a process plant. The student will be able to understand the basic layout of these units and to quantitatively predict the performance of these units. This will help to understand the applicability, potential, and limitations of different unit operations.

**Specialisation 2: Biochemistry**

Biochemistry for Industrial Chemists
This module is specifically designed to provide students with fundamentals on biochemistry required for a wide range of (industrial) applications in bioscience and biomedicine. Selected topics are gene regulation, protein expression and physiological metabolism in cellular reactions, structural aspects to gain insight into drug design and assay development for pharmaceutical applications. The module includes the structural and functional properties of DNA, proteins and interactions between molecules. An emphasis on gene regulation will lead to the understanding of metabolic processes and phamacological applications. The modifications of organisms like bacteria, yeast, insect or human cells provide the possibilities to produce large amounts of recombinant proteins for biological or medical applications. Since enzymes are widely used in industrial and medical applications, it is crucial to understand enzyme kinetics and bioassays to optimise production and quality. Modern (bio-) analytical techniques will be discussed and to characterise target molecules. Among these techniques are Mass Spectroscopy, NMR, X-ray crystallography, Spectroscopic and Fluorescent assays.

**Specialisation 3: General**
- Free Choice Specialisation 1
- Free Choice Specialisation 2
- Free Choice Specialisation 1 or 2 or from Elective Modules*

**Elective Modules** (Choose 3)
- Building Chemistry and Construction Chemicals
- Water Chemistry & Industrial Requirements
- Industrial Chemistry Marketing
- Production Planning in Chemical Industry
- Material Chemistry and Engineering
- Pharmaceuticals and Fine Chemicals
- Advanced Organic Synthesis and Spectroscopy
- Mathematical Methods in Chemical and Environmental Engineering
- Advanced Reaction Engineering
- Trace Analysis
- Advanced Organic Synthesis
- Topics in Supra-Molecular Chemistry
- Modern Analytical Technics
- Biomaterials

**Cross Discipline Modules**
- Legal Aspects in Chemical Industry
- International Intellectual Property Law
- Free Choice of Cross-Discipline Module offered in TUM Asia MSc programmes
**ADMISSION CRITERIA ***

- Hold a minimum 3-year bachelor degree in Chemical Engineering, Chemistry, or equivalent degree in other relevant disciplines
- Submit two (2) copies of Official / Provisional Bachelor Degree Certificates and two (2) copies of Official or Provisional Academic Transcript (Documents must be a certified true copy or notarised / attested copy format)
- Submit two (2) different recommendation letters from a Professor or an Employer
- Submit one (1) letter of motivation that indicates the reason(s) you are interested in the programme
- Submit one (1) Curriculum Vitae
- Submit two (2) Passport size photographs and one (1) Passport Biodata Page copy (the page with your personal particulars)
- TOEFL / IELTS (Required for applicants whose native tongue or medium of instruction from previous studies is not in English)
- Akademische Prüfstelle (APS) certificate (Required for applicants who hold a degree from China, Vietnam, or Mongolia)

TOEFL: Minimum 605 for the Paper-Based test / 234 for the Computer-Based test / 88 for the Internet-Based Test
IELTS: Overall IELTS results of at least 6.5

Important: Documents that are not in English must be translated by a certified translator
* Find out about the full application process on www.tum-asia.edu.sg/application-process

**TO APPLY**

Applications open 1st November every year. Apply online at www.tum-asia.edu.sg

**TUITION FEES**

<table>
<thead>
<tr>
<th>APPLICATION FEE</th>
<th>PAYMENT OF TUITION FEES</th>
</tr>
</thead>
<tbody>
<tr>
<td>S$70 (inclusive of GST) or Euro 45 is payable for each application per programme</td>
<td>A Total of SGD 48,150 * (Actual fee split into SGD and EURO)</td>
</tr>
</tbody>
</table>

Tuition fees includes teaching fees, examination fees, internet access on campus, laboratory expenses and cost of mandatory events. Expenses excluded from this fee and to be borne by students include: airfare, accommodation, and living expenses. The tuition fee will be paid in 3 installments.

* Tution fees are accurate as of 1 September 2014. Tuition fees are subject to revision due to currency fluctuations, at the discretion of TUM Asia. Fees quoted are inclusive of 7% Singapore’s Government Goods & Services Tax. Please refer to www.tum-asia.edu.sg/MScfees for the latest tuition fees.
Entrepreneurial Thinking and Engagement
Globalization is now an inevitable force that is here to stay. At TUM Asia, our classroom reflects this diversity with an enrolment of over 28 nationalities. This means that we foster a vibrant learning environment where the student learns not only from the textbook but also through the lives of their counterparts. Classroom ideas are synthesized across the diverse economic realities and students learn to see from multiple vantage points, creating a capacity to solve problems in creative ways. The unique 18 month joint degree equips the student with not only technical and scientific knowledge, but with an enriched curriculum composed of business and cultural modules.

Highest International Standards
You will be studying with the world’s best professors from TUM and NUS, as well as experts from the industry. Not only will the student benefit from professors who are actively involved in research, one will also receive a holistic learning experience with the engagement of local lecturers from academia and industry. Our TUM modules are covered by professors who fly in from Germany on an exclusive teaching basis, to ensure that students get the undivided attention of their lecturers.

The Industrial Chemistry course provides compelling insight into important topics of modern applied chemistry. It helps students to gain knowledge and to improve their creativity, which is of utmost importance for the future development of both society and industry. It also provides a solid basis to build upon for leadership positions that take part in shaping our future.

Prof. Dr. Fritz E. Kühn
Professor at Technische Universität München, Head of Molecular Catalysis, TUM

Studying at the Technische Universität München Asia
“Talents Are Our Assets, Reputation Is Our Return”

TUM CREATE - Centre for Electromobility
TUM is known for its research capabilities and strength in innovation. As such, TUM Asia spearheaded the set up of TUM CREATE as a base of research in Singapore. TUM Create is a joint programme between Technische Universität München (TUM) and Nanyang Technological University (NTU). The electromobility institute brings together the expertise and innovation of Germany and Singapore, to drive innovation to shape the future of sustainable mobility by tackling issues ranging from the molecules to the megacity. Graduates from the TUM Asia Master programmes have the opportunity to apply for positions at TUM Create, especially if your interest lies in research/electromobility.
DID YOU KNOW THAT SINGAPORE’S PETROCHEMICALS INDUSTRY AND OIL REFINERY IS ONE OF THE LARGEST IN THE WORLD?

Jurong Island: Singapore’s Dynamic Chemical Hub

Singapore’s position as a global chemicals hub has grown in tandem with the extensive development of Jurong Island - an integrated complex housing many of the world’s leading energy and chemical companies. Given Singapore’s strong track record for intellectual property rights protection, the nation is ideal for companies seeking to develop and commercialise proprietary technologies and first class manufacturing processes. Singapore aims to be a model of sustainable development by taking the lead to address climate change concerns and global resource constraints. Solutions involve energy efficiency, emissions management, and sustainable feedstocks and technologies.

The Chemical Industry in Singapore

As one of the world’s leading energy and chemical industry hubs, Singapore’s contribution to the industry is vast in terms of output and research. Mega growth trends like rapid urbanization, changing demographics and the rise of the Asian middle-class are shifting demand to Asia. Singapore is constantly working to stay at the forefront of the industry’s advancement, with the chemical and chemical products sector contributing S$38 million of the manufacturing output in 2010.

Our Graduates

Our graduates in Industrial Chemistry are employed all over the world, such as in Singapore (48.7%), Europe (33.9%), China (8.7%)

The most commonly accepted positions are Chemist, Research Engineer, Project Engineer, and Research Scientist

TUM Asia has close relationships with many of its industry partners. Our graduates are expected to be able to find positions with many companies, such as BASF, Clariant, and Evonik

The excellent academic education that tackled cutting edge topics in daily industrial business provided me with a sound understanding of how modern companies work. This unique combination equipped me with the right skills to drive value innovation in my projects.

Korwin Schelkle
Alumni, Master of Science in Industrial Chemistry
PhD Student, Spitzencluster Forum Organic Electronics

Partnering with highly qualified institutions such as TUM Asia puts us in touch with the talent of the future and gives these talented students the opportunity to drive innovation.

Clariant (Singapore) Pte. Ltd.