TUM Asia

MASTER OF SCIENCE

Aerospace Engineering

At a Glance

- The best of German engineering, infused with an Asian perspective
- Nurturing aerospace engineers of tomorrow
- Internationally recognised degree conferred by TUM
- Bright career prospects regionally and worldwide
- Apply online at **www.tum-asia.edu.sg**

Technical University of Munich

About TUM

Technical University of Munich (TUM)

The Technical University of Munich (TUM) was founded in 1868 and is one of Europe's leading technical universities. Serving as an entrepreneurial university that promotes talents and creates value for society, TUM has produced 18 Nobel Prize winners since 1927, most notably Ernst Otto Fischer (Chemistry) and Rudolf Mößbauer (Physics). Its focus areas are engineering sciences, natural sciences, life sciences, medicine, management and political and social sciences.

TUM promotes talents with its network of strong partners in research and industry. It is represented worldwide with the TUM Asia campus in Singapore, as well as offices in Beijing, Brussels, Cairo, Mumbai, San Francisco and São Paulo.

In international rankings, TUM regularly places among the best universities in Germany and worldwide. It is the only university to have won recognition as a German 'Excellence University' in every round since 2006.

Technical University of Munich (TUM) Asia

The Technical University of Munich (TUM) Asia was set up in 2002 as the first academic venture abroad by a German university, blending German academic excellence with industry relevance in Asia. Its partnerships with top Asian universities and industry leaders combine German engineering with Asian relevance to equip talents for industry and research sectors in the world.

With the changing needs of the economy, the specialised master's programmes that are offered keep pace with industry needs through an Asian-European perspective. Lecturers and professors hail from as far as Germany to equip students with their rich knowledge and experience.

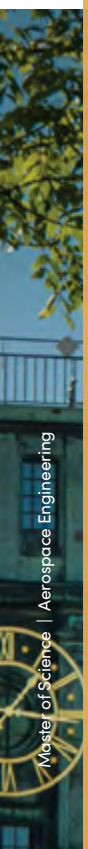
More than two thousand students have come through the doors of TUM Asia and now ply their trades in top research institutes and companies across the globe.

NO. 1 university
TUM is ranked as the no. 1 university in Germany+

NO. 13 in employability
TUM is ranked no. 13 in the Global Employability Survey^

19 Nobel Prize recipients
19 scientists and alumni of TUM have received the Nobel Prize

TOP 26 university
TUM is ranked 26th among the best universities in the world#



+ As rated by QS World Ranking 2025
^ As rated by Times Higher Education (THE) in the Global Employability University Ranking 2023-24
# As rated by Times Higher Education (THE) World University Ranking 2025

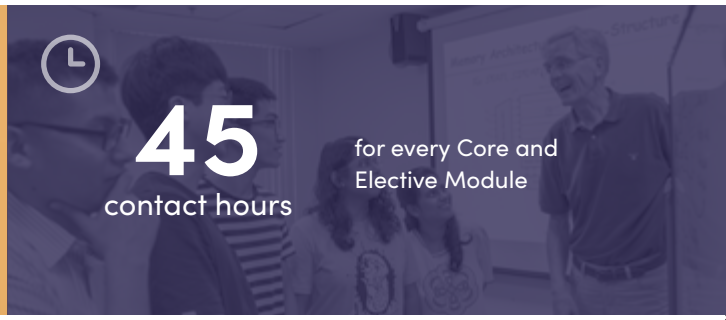
Programme Overview

Awarded by TUM, the **Master of Science in Aerospace Engineering (MSc in AE)** is a programme that caters to highly qualified engineers to meet the ever-increasing demand from a growing aerospace sector in Singapore and the world.

Programme Structure and Timeline

15 modules

- 5 Core Modules
- 7 Elective Modules
- 1 Non-Technical Elective Module
- 1 Lab Course
- 1 Business & Technical English Module



45 contact hours

for every Core and Elective Module

2 Years

- Full-time programme
- Coursework in Singapore
- Internationally-recognised degree

July	Year 1	Year 2	Graduation
Arrival in Singapore	• Core Modules • Elective Modules • Non-Technical Elective Module	• Elective Modules • Internship • Master Thesis at a company, university or research institute (Supervised by a TUM professor)	End of programme

Note: This outline is a general reference to the duration of study. A student's actual duration of study may or may not follow this general reference. This outline is subject to change during the course timetable.

Programme Modules

Core Modules

Introduction to Aeronautics
This module will provide a basic overview of the different systems and processes applied in aviation. A general understanding of civil and military aviation will be given to enable basic differentiation of different aircraft configurational layouts. In particular, the interaction among different system elements, their respective requirements and their impact on configuration level will be outlined.

Mechanics for Aerospace Engineers
Mechanics addresses the description and predetermination of the movements of bodies and their corresponding forces. Bodies at rest as a sub-field of mechanics are described in (elasto-)statics, the fundamentals of which are taught in this module. After successful participation, students are able to recognise static load-bearing structures in nature and technology and can extract mechanical models from reality, classify them in terms of analysis and calculate statically determinate as well as statically indeterminate systems using the methods they have learned. The basic methods learned contribute to the development of the ability to formulate mechanical issues in engineering problems and to solve them independently.

Aerodynamics
This module focuses on the basics of the calculation and the analysis of the aerodynamic forces acting on aircraft.

Introduction to Flight Mechanics
This module will cover topics in flight system dynamics and flight control. Students will be able to understand relations between aircraft performance and flight control. Through this course, students will be able to apply aircraft performance calculations that are required in the preliminary design of aircraft and will be able to design basic flight controllers for stabilisation and improvement of flight properties.

Flight Propulsion
The module provides basic knowledge about aerospace propulsion systems. The basic governing thermodynamic and aerodynamic equations used in the engine design process, Aero engine and gas turbine cycle and component performance as well as their interaction will be covered.

Structures and Materials
This module covers the essentials of lightweight structures and materials, which provide a basis for structural development, including proper material selection. A general view on the basics of elasticity, structural stability, vibrations and strength, including fatigue problems, is given. Design, numerical analysis and test methods are introduced. On the materials side, metal lightweight alloys and fiber composites are covered.

Compulsory Lab Modules

Numerical Methods and Tools in Aerospace Engineering (Lab Course)
This module provides a comprehensive introduction to the functionality of the software MATLAB / Simulink and explains the aerospace engineering problems the tool can be used to solve. Emphasis is placed on numerical modelling of technical problems and the engineering interpretation of results. For dynamic vibration behavior, syntheses will be made with control simulation to show the interaction of several disciplines and to introduce the field of controlling flexible systems to students.

Structural Modelling Lab
The course demonstrates the use of common Finite Element software tools using typical examples from the field of aerospace structures. The most important basics of FEM, and modelling aspects will be covered. Typical questions in the structural calculation from the areas of statics and dynamics serve as examples. With the knowledge gained, aeronautical structures can be modelled, analysed and evaluated with regard to their characteristics.

Aerodynamic Modelling Lab
The course provides an introduction to fluid dynamics modelling for aerospace applications. After successful participation, students are able to understand different models and methods available in current flow simulation tools. The set-up and execution of flow simulations as well as the analysis and evaluation of the results are discussed. Upon successful completion, participants will be able to analyse and evaluate aerodynamic properties, such as forces and pressure distributions, as required in the aircraft design process.

Elective Modules*
(Choose 8)

Additive Manufacturing
The module is an introduction to additive manufacturing and focuses on additive manufacturing technologies for both polymers and metals. The entire process chain of additive manufacturing is discussed, including feedstock materials, part design, production processes, monitoring, post-processes, and standardization. The module is enriched by exemplary applications, expert talks from industry, and field trips.

Advanced Flight Control Systems
This module conveys complex control concepts for aircraft. How the C*-criterion is derived and modern concepts of adaptive control in aviation are covered.

Aerodynamic Design of Turbomachinery
This module covers the various types of turbomachinery applications with particular emphasis on compressors. Starting from the fundamental equations in fluid dynamics, the working principles of turbomachinery are derived. Moreover, main components, characteristics and associated flow phenomena are explained. For compressors, design methods and processes, topics of operability and stability enhancement are covered.

Aeroelasticity
This module describes basic aeroelastic phenomena arising from the mutual interaction of elastic, aerodynamic and inertial forces on a structure, with special emphasis on problems related to fixed wing vehicles. Aeroelasticity plays a major role in the design, qualification and certification of flying vehicles, as it contributes to the definition of the flight envelope and affects various performance indicators.

Aerospace Structures
This module introduces the approaches for the development process of lightweight and aerospace structures, including design, simulation, optimisation and testing aspects. Current structural design concepts for aerospace applications are shown in the context of goals and requirements to be achieved. Possible future developments and reasons for these will be addressed and discussed.

Aircraft Design
This module covers various current design methods and relevant design tools for the applied design of surface aircraft. With the simultaneous introduction to the aircraft design system, students will be able to design both individual components of the aircraft with regard to the overall aircraft, and define the overall aircraft configuration so that it complies with the current requirements with regard to safety, safety and security economy, comfort, the environment and the performance of flights.

Boundary Layer Theory
This module covers basic phenomena present in boundary layers. Physical models and the derivation of the boundary layer equations from the Navier-Stokes equations are discussed for flat 2-dimensional cases. Temperature, compressible and 3-dimensional boundary layers are explained. The stability theory explains the laminar-turbulent transition, turbulent boundary layers and experimental research methods.

Flight Control Systems
This module introduces the basic operating principle of flight controls. Based on the non-linear equations of motion of airplanes and basic control theory principles, control strategies are derived in order to improve the handling qualities or stability of airplanes. In addition, strategies for the implementation of autopilots are presented.

Helicopter Engineering
The content extends over different design requirements and their classification, the sizing process, evaluating the flight performance with respect to power consumption, rotor craft limits and mission design. It also covers tools for the cost and weight estimation of the designed rotorcraft.

Safety and Certificate of Aircraft
This module covers Aviation Safety Principles, Basics in Regulations, Airworthiness Code (CS-27, CS-29), Loads, Stress and Fatigue, Performance Categories, Safety Analysis and Flight Accident Investigation. During the presentation of the basic chapters of flight safety and certification the students have the possibility to discuss the important aspects together with the professor. The module covers following chapters such as Aviation Safety Principles, Basics in Regulations Airworthiness Code (CS-27, CS-29), Loads, Stress and Fatigue, Performance Categories, Safety Analysis, and Flight Accident Investigation.

Safety and Certification of Avionics and Flight Control Systems
This module addresses the certification process of avionics and flight control systems in commercial aviation. The focus lies in safety analysis methods, taking common approaches of their employment in development projects of safety-critical systems in the industry into account. The course begins with giving a general overview of the development and certification of flight control systems, along with the contents of relevant development standards and recommended practices and the resulting process structure. Based on this, profound knowledge of the process and methods of safety assessment of complex technical systems in aircraft is conveyed.

Spacecraft Technology
This module covers astronautical and space engineering topics, and relevant theoretical background and engineering design methods to find suitable solutions for spaceflight and spaceflight technology. The module will be following the processes and technologies from launch (physics of spaceflight, rockets, propulsion, trajectory, spaceflight environment) to orbit with topics in physics (orbital mechanics and dynamics, interplanetary flight, navigation) and engineering subsystem technologies (power, thermal, communication, sensors, actuators). The topics and processes will be presented with practical applications in mind.

Non-Technical Elective Modules
(Choose 1)

Business Administration
The primary purpose of the module is to introduce students to the different areas of business administration, while the final objective is to give them a basic understanding of how to face decision problems in a company. Most importantly, students will analyse long-term investment decisions, how to set up strategic planning in a company, how to gather timely information about the current situation of a company, and how to set up its long-term financial structure.

Innovation and Technology Management
This module presents the dynamics of technological development through innovation and related management issues, the difference between creating a new product (invention) and improving an existing product/ idea (innovation), start-ups and financing of innovation, innovation-driven economic cycles and innovation impact on growth and jobs.

*__Disclaimer:__ Elective modules available for selection are subject to availability. Unforeseen circumstances that affect the availability of the module include an insufficient number of students taking up the module and/or the unavailability of the professor. TUM Asia reserves the right to cancel or postpone the module under such circumstances. TUM Asia will update the list of non-technical electives from time to time. Kindly refer to our webpage for the updated list of non-technical electives.

The TUM Experience

The TUM Asia's Aerospace Engineering programme has provided me with the technical knowledge to solve engineering problems in a structured way and find the best possible solution. I have built up a great network while living abroad and a strong foundation in the field of Aerospace Engineering.

Jannik Pötzl
Alumni
Master of Science
in Aerospace Engineering

Entrepreneurial Thinking and Engagement

You will formulate and discuss ideas based on the diverse economic realities and learn to see from multiple vantage points. The unique joint degree programme equips you not only with the technical knowledge, but also with the business and cultural aspects of the subject.

Industry Relevance

Our professors – the world's best – are industry experts and active researchers. This allows you to learn from a curriculum that is built around the latest technological trends and knowledge.

Highest International Standards

You will receive a holistic learning experience with the 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 you receive their undivided attention.

Global Prospects

You can choose to complete your internship and thesis in Singapore or anywhere in the world with a company, university or research institute. Your internationally recognised degree and experience is a great boost to your profile for future global job opportunities.

TUMCREATE

TUMCREATE was founded in 2010 as a research arm to foster research collaborations between TUM, Singapore and other top universities in the world in the advancement of electromobility, smart cities, medical technology and now food science. To date, TUMCREATE contributed more than close to 650 publications, developed 10 patents and innovations with more than 69 PhD candidates successfully trained in various specialisations. Graduates have the opportunity to apply for positions at TUMCREATE. especially if your interest lies in the areas of energy, medical technology and food science.

Industry Outlook

Known as the "Aerospace City of the Future", Singapore boasts one of Asia's largest and most diverse aerospace ecosystems with more than 130 key players such as Airbus, Collins Aerospace, Rolls-Royce, ST Engineering and SIA Engineering.

Singapore – Asia's Aerospace Hub

As Asia's leading one-stop solutions provider for aircraft maintenance, repairs and overhaul (MRO) needs, the aerospace engineering industry in Singapore is home to leading aerospace companies, contributing 10% to global MRO output. Its excellent connectivity and infrastructure make Singapore a world-class base for aerospace firms' regional distribution centres.

The aerospace and defense industry in Singapore is expected to grow rapidly as more foreign direct investments pouring in the aerospace sector and the participation of private companies and start-ups in space technology grows.

Academic	28%
Engineering (incl. Aerospace Engineering)	15%
Aerospace industry	14%
Research	12%
Industrial and Manufacturing	13%
Automobile and Transport	7%
Technology	6%
Others	5%

Source: https://www.edb.gov.sg/en/our-industries/aerospace.html
https://www.mordorintelligence.com/industry-reports/singapore-aerospace-and-defense-market

Our Graduates

Our graduates in Aerospace Engineering are employed all over the world, with a majority in Singapore, China and Europe.

The most commonly accepted positions are Research Engineer, Project Engineer, Stress Engineer, and Mechanical Design Engineer.

Others may also choose to continue their academic journey with a doctoral candidate position (PhD).

Singapore is

NO. 1

in Asia for MRO. It is also the most comprehensive MRO in Asia.

Total output of

S$11.3 billion

1,000 new jobs

are to be introduced by 2020.

The Aerospace industry employs close to

>22,000

aerospace professionals

Today, over

130

international companies carry out MRO activities in Singapore.

Programme Fees

	Before GST	After GST
Processing Fee+ Per application	SGD 100	SGD 109
Tuition Fee+ Aerospace Engineering	SGD 36,000	SGD 39,240

Scholarships & Grants

For more information, please visit: https://tum-asia.edu.sg/admissions/graduate-studies/scholarships/

Admission Criteria

- **Bachelor's degree** in **Aerospace, Mechanical Engineering, Advanced Mechanics, Mechatronics, Robotics, Avionics, Aircraft Engineering** or a closely related discipline
- **Bachelor's degree certificate** or **enrolment letter*** (if you have not completed your bachelor's degree)
- **Academic transcripts** or **mark sheets**, including the credits/grading system of your university*
- **Module descriptions** of all the modules you have taken for your bachelor's studies, as found in your curriculum document or syllabus handbook (only required in softcopy format)
- **Statement of purpose** indicating the reason(s) you are interested in this programme
- **Curriculum Vitae / Résumé**
- **TOEFL** test score (≥88 for Internet-based test, DI code: 7368) or **IELTS** test score (≥6.5 overall) taken no more than two years ago from date of submission
- **Akademische Prüfstelle (APS) certificate** for applicants who hold a degree from China, India and Vietnam

+ Tuition fees are to be paid in 3 instalments.

+ The tuition fee includes teaching fees, laboratory expenses and cost of mandatory events. The tuition fee does not include airfare, accommodation, living expenses, and miscellaneous fees (registration, IT facilities, matriculation, examination, amenities, copy right, sports, insurance and medical).

+ All fees quoted are in Singapore dollars and are subject to the prevailing Goods and Services Tax (GST) rate imposed under the Singapore GST Act. Final tuition fees are subject to revision due to changes in GST rate and/or at the discretion of TUM Asia, and students will be informed accordingly. Please refer to our website for the final tuition fee and other fee updates.

* Documents that are not in English must be translated by a certified translator. Credits/ grading system of your university is required:
  - min. passing score (e.g. 50 out of 100);
  - max. possible score (e.g. 100 out of 100); and
  - the equivalent score/range of scores for each grade (e.g. 'A' grade is equivalent to a score of 90 to 100).

The full application process and documents required for submission is available at www.tum-asia.edu.sg/admissions/graduate-studies/application/

Applications open on 1 October every year.

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