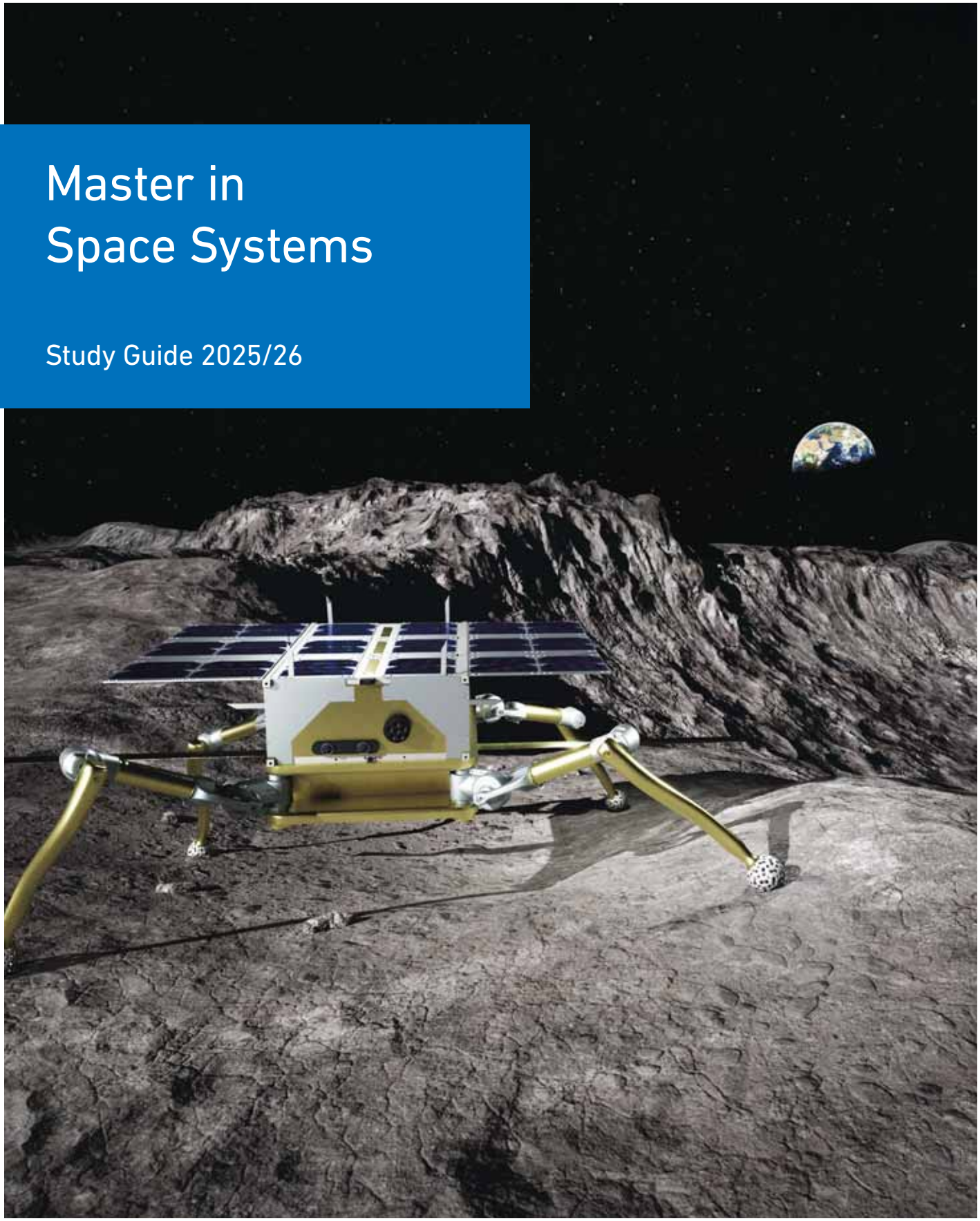
ETH zürich

Department of
Earth and Planetary Sciences

Master in Space Systems

Study Guide 2025/26



D EAPS

Master's Programme in Space Systems

Study Guide 2025/26

Issue January 2026

This Study Guide provides practical information on the Master's degree programmes in Space Systems. The legally binding documents for each Master's degree programme in the Department of Earth and Planetary Sciences are:

– **Master's degree programme in Space Systems**
  German version of the programme regulations "Studienreglement 2024 für den Master-Studiengang Space Systems"
  ↗ ethz.ch/content/dam/ethz/main/eth-zurich/organisation/rechtssammlung/324.1.1003.40.pdf

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Glossary

D-EAPS	=	Department of Earth and Planetary Sciences
D-GESS	=	Department of Humanities, Social and Political Sciences
D-ITET	=	Department of Information Technology and Electrical Engineering
D-MAVT	=	Department of Mechanical and Process Engineering
D-PHYS	=	Department of Physics
UZH	=	University of Zurich
Erfa	=	Earth Sciences student association
ECTS	=	European Credit Transfer System
KP	=	Number of credits (ECTS)
FS	=	Spring Semester
HS	=	Autumn Semester

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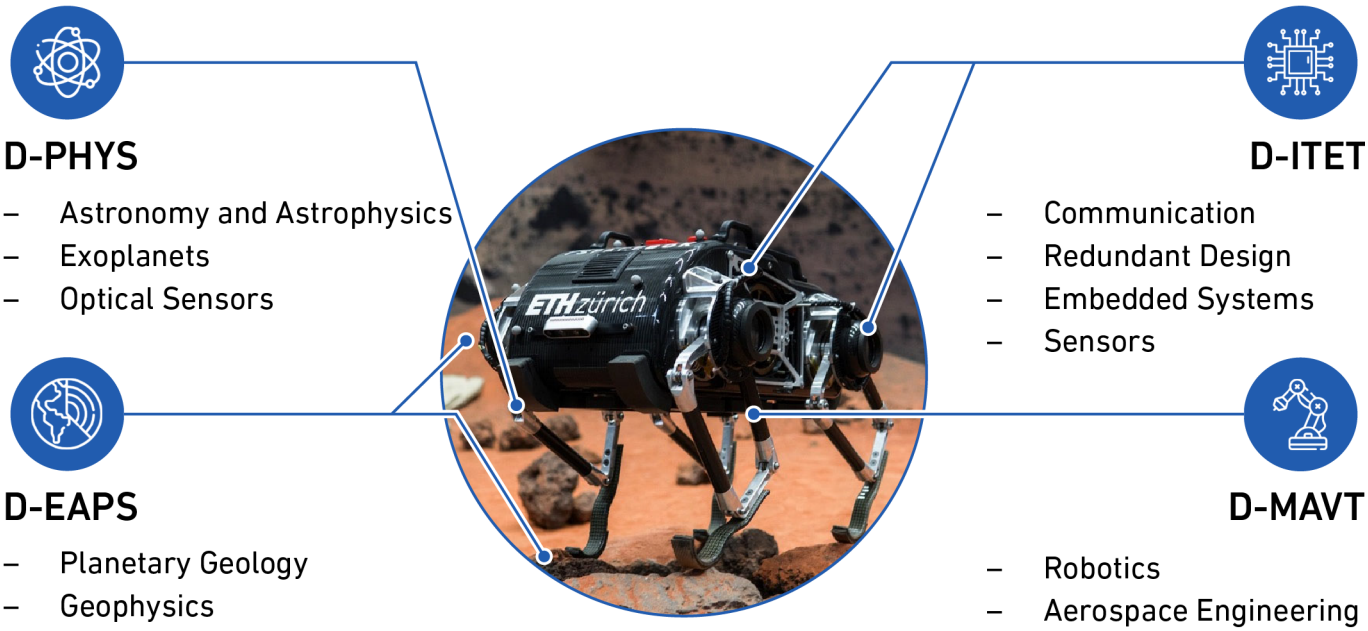
1 Studying Space Systems at ETH Zurich

The space industry is experiencing an unprecedented period of growth and diversification, both in terms of technological advancements and market dynamics. The specialised Master in Space Systems offers students the opportunity to enter this dynamic environment.

The Department of Earth and Planetary Sciences (D-EAPS) encourages collaborative study within different departments and universities. To achieve a world-class interdisciplinary and cross-disciplinary Master's programme designed to prepare the next generation of space engineers and scientists, the Master's Study Programme in Space Systems is built at ETH Zurich in close collaboration with the Swiss space industry and the four ETH departments:

– Department of Earth and Planetary Sciences (D-EAPS)
– Department of Information Technology and Electrical Engineering (D-ITET)
– Department of Mechanical and Process Engineering (D-MAVT)
– Department of Physics (D-PHYS)

The term "space systems" encompasses all the technologies that are required for human and robotic activities in space. The Master's degree programme in Space Systems offers a comprehensive overview of modern space systems, with a special emphasis on the new space sector. It combines the relevant technical, scientific, and political aspects with a focus on sustainability, innovative technologies and working in interdisciplinary teams. Graduates of the programme can use both analytical approaches and modelling tools to develop and analyse space systems in a targeted and responsible manner.



1.1 Learning goals

The goal of the Master's degree in Space Systems is to prepare students for a job in one of the specialised fields of space engineering and sciences.

Graduates of this programme will be able to analyse and design spacecraft, satellites, and instruments (space systems) with a focus on scientific and commercial applications, such as:

– Observing the Earth's surface to monitor land use and climate change and find new resources as well as hidden sources of greenhouse gases.

– Investigating methods for the sustainable use of space.

– Advancing planetary science and life detection with probes in our solar system and beyond using space-based telescopes.

– Detecting solar eruptions early to safeguard satellites and communication systems.

Furthermore, graduates of this programme have:

– A sound knowledge of space systems and an in-depth understanding of the respective specialisation.

– A wide understanding of the scientific objectives of space missions, carrier systems and satellites, and of the relevant subsystems addressed in the respective specialisation, such as sensor technology, instruments, propulsion, navigation, and control systems.

– Active experience of designing and analysing space systems in a team with a focus on sustainability.

– Specialised knowledge in the topic of their Master's thesis.

1.2 Job opportunities

The Master's degree in Space Systems qualifies its holders to assume research and development tasks in the space sector at universities or space agencies, to act as systems engineers or specialists in both the traditional and the new space industries, and to pursue research and development in the public sector where space data and/or technologies are involved.

The outstanding expertise of the Master's in Space Systems graduates makes them particularly attractive to the job market in the following areas:

- Systems engineers in satellite or spacecraft design and development
- Space system architects
- Mission design engineers
- Production engineers
- Data analysts in industry and agencies
- Scientists in space-related fields
- Principal investigators in space missions or experiments (doctorate required)

2 Planning the Master's studies

This chapter gives an overview on how the programme is structured and highlights important administrative elements to support students in managing their Master's studies at ETH Zurich.

The study programme follows a credit system consistent with the European Credit Transfer System (ECTS). One credit (KP) corresponds to one ECTS, which is equivalent to 25–30 hours of work, including independent study. Students must obtain 120 ECTS to qualify for the Master's Degree in Space Systems.

Description of course units and details on performance assessments are listed in the legally binding course catalogue[1].

2.1 Steering committee

The study programme is led by a scientific programme director and supported by a steering committee that is composed of the following members:

– Director of Studies of the study programme (member of D-EAPS)

– Up to two professors or senior scientists each from D-EAPS, D-MAVT, D-ITET, and D-PHYS

The steering committee appoints tutors, either professors or qualified senior scientists and designates professors authorised to supervise a Master's thesis.

2.2 Tutor system

Each student of the Master's programme in Space Systems is supervised by a tutor.

When applying for the Master's programme students must list three potential tutors relevant to the student's deep track. The tutor is assigned by the admission committee at the beginning of the first semester. The objective of the tutor system is to help students developing an individualised learning agreement outlining their planned courses and to offer support on a one-to-one basis up to their graduation.

The tutors of the Master's programme in Space Systems consist of professors or senior scientists from the contributing departments, the contact details are available on the programme website[2].

A change of tutor can be requested only in special cases and must be formally requested to the Director of Studies. Such requests are only considered at the beginning of each semester and do not result in an extension of the study duration.

1 www.vorlesungen.ethz.ch

2 eaps.ethz.ch/en/studies/master/space-systems

2.3 Learning agreement

The learning agreement[3] ensures a well-ordered and rational programme while taking the student's individual ideas and expectations into consideration. It is created in myStudies[4] and discussed with and approved by the assigned tutor of the chosen deep track. It must be turned in to the tutor within three weeks from the start of the semester. Subsequent changes are subject to approval by the tutor. Only courses listed in the learning agreement will be credited.

Important note
Only the scientific introductory courses, deep track courses, and electives are part of the learning agreement. The Science in Perspective courses, and the Master's thesis are not listed in the learning agreement since they are a mandatory part of each study programme of ETH Zurich.

2.4 Registration for course units

Semester enrolment and all course registration is done via the web application myStudies. The personal weekly schedule can be checked in accordance with the enrolments. The cancellation of a course must be done within the first four weeks of the semester.

Students at universities that have official cooperation agreements with ETH Zurich (such as the University of Zurich) may register as special students.

2.4.1 Registration for projects, papers, or theses

Projects like a semester research project or the Master's thesis must be registered via myStudies (by selecting "projects/papers/theses"). The registration status is only definite after confirmation by the tutor and/or the project supervisor.

2.4.2 Registration for modules at the University of Zurich

Students from ETH Zurich may attend individual course units (modules) at the University of Zurich, take assessments and receive credit points. ETH Zurich recognises these academic achievements if they follow the valid regulation and with prior approval by the study advisor of the chosen major.

The registration at University of Zurich for students of ETH Zurich is called "Module Mobility - Registering for studies at more than one university"[5]. Students of ETH Zurich do not have to pay any fees. Note that there is only a short time frame to register for modules.

The assessments of modules taken at the University of Zurich by ETH students is sent to ETH Zurich electronically. After validation of the data, students receive an email and can view the grade in their ETH transcript (myStudies).

3 ethz.ch/applications/teaching/en/applications/mystudies/matriculation/display_lag

4 mystudies.ethz.ch

5 uzh.ch/en/studies/application/chmobilityin (strict deadlines apply)

2.5 Performance assessment

At ETH Zurich, there are the following types of performance assessments[6]:

– Session examinations additional registration for the exam in myStudies
– End-of-semester examinations additional registration for the exam in myStudies
– Semester performance assessments

The examination type of a course is published in the course catalogue[7] and in myStudies[8]. The legally binding regulations concerning all types of performance assessments are described in the General Ordinance for Performance Assessments at ETH Zurich[9].

2.6 Request for degree and graduation

The request for degree can be submitted as soon as the minimum required credit points have been obtained. The request must be printed via myStudies, signed, and handed in to the Study Administration Office electronically or in person. Based on the request, the following documents are issued:

– Final academic record, with or without an addendum
– The diploma (degree) certificate

The successful completion of the Master's programme at the Department of Earth and Planetary Sciences entitles graduates to bear the following academic titles (depending on the Master's degree programme chosen):

– **Master of Science ETH in Space Systems**
(MSc ETH Space Systems)

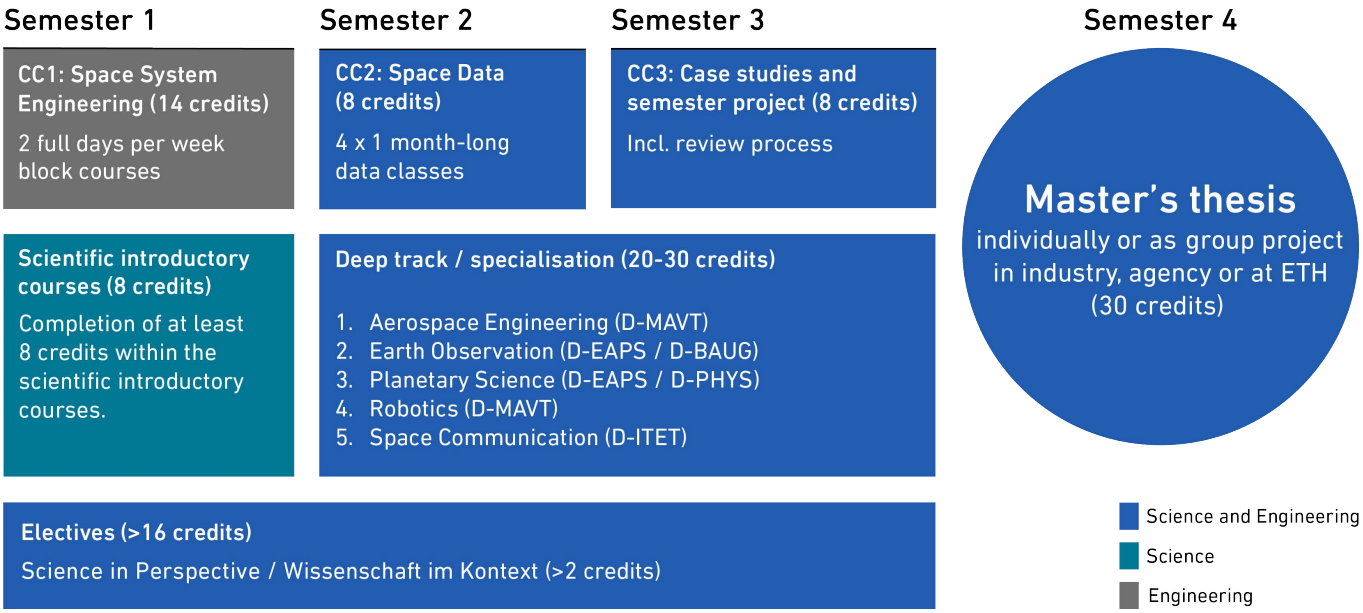
6 ethz.ch/students/en/studies/performance-assessments/examination-information
7 www.vorlesungen.ethz.ch
8 mystudies.ethz.ch
9 fedlex.admin.ch/eli/cc/2012/446/de

3 Structure of the programme

The Master's degree programme in Space Systems entails a total of 120 credits. The structure of the Master's degree programme ensures that the topics are adequately covered. The students define the main area of their educational path by choosing one of the five specialisations (deep tracks) supervised by several tutors:

– Aerospace Engineering
– Earth Observation
– Planetary Science
– Robotics
– Space Communication

The programme is organised into six categories, in each of these categories a minimum number of credits must be completed.



The programme itself is designed with a strong project focus. Core course 3 includes a semester project conducted in a group at ETH Zurich or in collaboration with a company, offering valuable scientific or industry experience.

3.1 Core courses

The three core courses (total of 30 ECTS) provide fundamental, broad knowledge about the key areas of the programme and are compulsory for all students.

3.1.1 Space System Engineering

This course provides a thorough grounding in both the theoretical and practical aspects of space systems engineering. Students work in teams on a semester-long project to design a space mission in collaboration with an industrial or governmental partner. The project includes key milestones, design reviews, and concludes with a final presentation and detailed mission report. Practical experience is further enhanced through the construction and launch of a small science mission at a designated site, promoting teamwork and the real-world application of academic knowledge.

Core course 1

Number	Title	Semester	ECTS
651-7001-00	Space System Engineering	HS	14 KP

3.1.2 Space Data

Space missions generate vast amounts of data – not only scientific data from payloads, but also technical data collected during testing, launch, and operations. This course provides students with practical skills in analysing such data efficiently, using methods that are broadly applicable across space science and engineering problems. Core topics include spectral and time–frequency analysis, clustering, principal component analysis, and modern neural network approaches. Through hands-on exercises with real datasets from academia and industry, students will practice in-class analysis, complete targeted homework assignments, and produce structured reports.

Core course 2

Number	Title	Semester	ECTS
651-7002-00	Space Data	FS	8 KP

3.1.3 Case Studies Seminar and Project

Core course 3 provides practical experience in the development of a real-world space mission or its subsystems. Building on the theoretical foundations introduced in core course 1 and the data methodologies covered in core course 2, students apply systems engineering principles and undertake mission-focused project work. Emphasis is placed on decision-making, interdisciplinary collaboration, and practical problem-solving within the framework of large-scale space initiatives.

Core course 3

Number	Title	Semester	ECTS
651-7003-00	Case Studies Seminar	HS	2 KP
651-7003-01	Case Studies Semester Projects	HS	6 KP

The semester project can be done in one of the following formats. Further details are available on the study programme's webpage[10]:

– **ETH-based research projects**
  Conducted within an ETH research group, these projects contribute to ongoing or conceptual space missions and involve academic work in mission design, technology development, or scientific investigation.

– **Externally supervised projects**
  Carried out at external institutions such as research centres or companies in Switzerland or abroad, these projects require academic supervision by an ETH professor to ensure the relevance of the project to the Master's programme.

– **Self-proposed projects**
  Student teams (max. 5 students) may propose their own project, particularly those focused on commercialisation or the development of novel space technologies. Projects must have a clear mission objective and demonstrate feasibility and innovation.

A supporting seminar fosters reflection, knowledge sharing, and discussion of project development.

3.2 Scientific introductory courses

To impart a deep understanding of the scientific motivation behind space missions to students, the scientific introduction courses are a mandatory part of the programme for all deep tracks. Students must complete at least two out of the six scientific introductory courses to reach a minimum of 8 credits.

Number	Title	Semester	ECTS
102-0675-00	Earth Observation	HS	4 KP
651-7011-00	Introduction to Planetary Science	HS	4 KP
651-7012-00	The Physics of Space Weather	HS	2 KP
402-0247-00	Electronics for Physicists I (Analogue)	HS	4 KP
151-0106-00	Orbital Dynamics	FS	4 KP
701-1232-00	Radiation and Climate Change	FS	3 KP

10 eaps.ethz.ch/en/studies/master/space-systems/semester-project

3.3 Deep track courses

The programme offers five different deep tracks such as Aerospace Engineering, Earth Observation, Planetary Science, Robotics, and Space Communication.

By selecting one of the specialised deep tracks students define the main area of their educational path. The tutor system is designed to ensure students receive the optimal support in setting up their personalised learning agreement.

Students must complete at least 20 credits within the deep track courses.

3.4 Electives

To deepen their knowledge in Space Systems or to complement it with studies in other disciplines students must complete a minimum of 16 credits of additional elective courses from the overall offering of ETH Zurich.

While all courses offered by ETH Zurich can be accounted for as electives, a recommended list of elective courses is available, depending on the chosen deep track.

3.5 Science in Perspective

All ETH Zurich students must attend two credits worth of courses at the Department of Humanities, Social and Political Sciences (D-GESS) to achieve a Master's degree[11].

The Science in Perspective (SiP) coursework enables ETH Zurich students to perceive and analyse the societal context of their future activity as scientists and/or engineers. The aim of the SiP is to critically analyse and put specialist knowledge from the natural and technical sciences into a social context. They encourage holistic and future-oriented knowledge communication. This provides awareness of new ways of thinking and alternative scientific approaches and contributes to the personal development of students.

11 gess.ethz.ch/en/studies/science-in-perspective

3.6 Master’s thesis

The Master’s thesis marks the conclusion of the Master’s programme and is supervised by one supervisor. All professors entitled to supervise a Master’s thesis are listed on the study programme webpage[12]. With the Master’s thesis, students are expected to demonstrate their ability to engage in independent and scientifically structured work. The Master’s thesis may be connected to a so-called Team Focus Project from the core courses.

Before starting on the Master’s thesis, students must:

– Have obtained their Bachelor’s degree.

– Have fulfilled all additional requirements (if any).

– Have obtained the necessary credit points in the Master's programme in the categories core courses and scientific introduction courses are eligible for the Master's thesis.

Students submit a proposal for the topic of their Master’s project to the supervisor. The project should be closely related to the research activities of the supervisor.

If the Master’s thesis is carried out as group work (only possible with the supervisor’s agreement), the performance of the participating students is assessed individually with a grade. The assignment of tasks among the participating students and the modalities of assessment are jointly defined by the students and the supervisor.

If the Master's thesis is completed outside of ETH Zurich, the supervisor must submit a justification to the Director of Studies for approval.

Please refer to the guidelines (available in 2025) published on the programme webpage for further information.

12 eaps.ethz.ch/en/studies/master/space-systems

4 Deep tracks

Students begin engaging with their chosen deep track in the second semester building specialised expertise based on their learning agreement. Elective courses offer opportunities to explore inter-disciplinary topics or deepen expertise within the chosen deep track.

4.1 Deep track Aerospace Engineering

The deep track Aerospace Engineering is designed to provide comprehensive knowledge and skills in key areas of aerospace technology, as presented at ETH Zurich. Core topics include:

- Structural mechanics, especially lightweight and composite technologies
- Fluid dynamics, including aerodynamics and propulsion
- Control theory, with an emphasis on digital systems
- Orbital mechanics

Aerospace Engineering courses (minimum of 20 credits)

Aerodynamics and Propulsion

Number	Title	Semester	ECTS
151-0204-00	Aerospace Propulsion	HS	4 KP
151-1116-00	Introduction to Aircraft & Car Aerodynamics	HS	4 KP
151-1115-00	Aircraft Aerodynamics and Flight Mechanics	FS	4 KP
151-0252-00	Gas Turbines: Thermodynamic Cycles and Combustion Systems	FS	4 KP

Structure and Materials

Number	Title	Semester	ECTS
151-3207-00	Lightweight Structures	HS	4 KP

Geodesy

Number	Title	Semester	ECTS
103-0187-00	Satellitengeodäsie	HS	4 KP

System Engineering

Number	Title	Semester	ECTS
151-0280-00	Advanced Techniques for the Risk Analysis of Technical Systems	FS	4 KP

Embedded and Autonomous systems

Number	Title	Semester	ECTS
227-0124-00	Embedded Systems	HS	6 KP

Fluid Dynamics

Number	Title	Semester	ECTS
151-0109-00	Turbulent Flows	HS	4 KP
151-0293-00	Fundamentals and Applications of Combustion	HS	4 KP
151-0110-00	Compressible Flows	FS	4 KP

Computational Science and Engineering

Number	Title	Semester	ECTS
151-0563-01	Dynamic Programming and Optimal Control	HS	4 KP
151-0212-00	Advanced CFD Methods	FS	4 KP

Dynamics

Number	Title	Semester	ECTS
151-0106-00	Orbital Dynamics	FS	4 KP

Recommended elective courses (minimum of 16 credits)

Students choosing the deep track Aerospace Engineering are encouraged to deepen their knowledge in specific fields by choosing a selection of the recommended elective courses. At least 16 credits must be completed within the elective courses.

Geodesy

Number	Title	Semester	ECTS
103-0187-01	Space Geodesy	HS	6 KP

System Engineering

Number	Title	Semester	ECTS
227-0377-10	Physics of Failure and Reliability of Electronic Devices and Systems	HS	3 KP

Fluid Dynamics

Number	Title	Semester	ECTS
151-0368-00	Aeroelasticity	HS	4 KP
151-0207-00	Theory and Modeling of Reactive Flows	FS	4 KP

Computational Science and Engineering

Number	Title	Semester	ECTS
151-0213-00	Fluid Dynamics with the Lattice Boltzmann Method	HS	4 KP
701-1270-00	High Performance Computing for Weather and Climate	FS	3 KP
401-0674-00	Numerical Methods for Partial Differential Equations	FS	8 KP

Dynamics

Number	Titles	Semester	ECTS
151-0532-00	Nonlinear Dynamics and Chaos I	HS	4 KP
151-0215-00	Fundamentals of Acoustics	HS	4 KP
151-0530-00	Nonlinear Dynamics and Chaos II	FS	4 KP
151-0232-00	Engineering Acoustics II	FS	4 KP

4.2 Deep track Earth Observation

The deep track Earth Observation teaches methods of Earth observation from space, with a focus on electromagnetic methods, ranging from radar to hyperspectral optical. It also teaches typical use cases, specifically monitoring of the biosphere and climate research. A goal is to motivate students to come up with use cases that can be implemented with current ESA or commercial missions. The track is offered in close collaboration with the University of Zurich.

The courses in this deep track are not categorised into mandatory or elective courses. In collaboration with their tutor, students set up a personalised learning agreement tailored to their academic interests and career goals. Students will choose deep track courses for specialised knowledge (at least 20 credits) and elective courses (at least 16 credits) to further explore and deepen their knowledge in diverse disciplines.

Students are encouraged to choose the elective courses from the programme's course list. However, they also have the option to select courses from the entire catalogue of ETH Zurich and the University of Zurich.

Earth Observation courses (minimum of 20 credits)

Number	Title	Semester	ECTS
102-0617-00	Basics and Principles of Radar Remote Sensing for Environmental Applications	HS	3 KP
102-0627-00	Applied Radar Remote Sensing	HS	3 KP
103-0187-01	Space Geodesy	HS	6 KP
103-0287-00	Image-based Mapping	HS	6 KP
151-0632-00	Vision Algorithms for Mobile Robotics (UZH)	HS	6 KP
227-0014-00	Computational Thinking	HS	4 KP
651-2338-00	Remote Sensing and Geographic Information Science III (UZH)	HS	5 KP
651-4257-00	Advanced Technologies and Methods in Active Remote Sensing (UZH)	HS	6 KP
651-4263-00	Remote Sensing and Geographic Information Science V (UZH)	HS	5 KP
651-4269-00	Advanced Technologies and Methods in Passive Remote Sensing (UZH)	HS	6 KP
651-7104-00	Spatial Ecology and Remote Sensing (UZH)	HS	2 KP
701-1241-00	Atmospheric Remote Sensing	HS	3 KP
701-1251-00	Land-Climate Dynamics	HS	3 KP
701-1613-00	Landscape Patterns and Processes	HS	5 KP
102-0617-01	Methodologies for Image Processing of Remote Sensing Data	FS	3 KP
103-0178-00	Geodetic Earth Monitoring	FS	6 KP
252-0220-00	Introduction to Machine Learning	FS	8 KP
651-2332-00	Remote Sensing: Seminar & Colloquium (UZH)	FS	6 KP
651-4278-00	Monitoring the Earth with Radars from Satellites Information	FS	4 KP
651-7111-00	Biosignatures and Life Detection (UZH)	FS	2 KP
651-7114-00	Computational Methods for Radiative Transfer (UZH)	FS	4 KP

Number	Title	Semester	ECTS
651-7117-00	Remotely Sensing the Basis of Biodiversity	FS	6 KP
701-0478-00	Introduction to Physical Oceanography	FS	3 KP
701-1222-00	Weather and Climate Modelling	FS	4 KP
701-1232-00	Radiation and Climate Change	FS	3 KP
701-1674-00	Spatial Analysis, Modelling and Optimisation	FS	5 KP

4.3 Deep track Planetary Science

The deep track Planetary Science teaches the fundamentals of Geosciences as it is necessary to understand current scientific activities of ESA and NASA in the solar system.

A focus is on understanding the fundamental physical and chemical processes governing the formation and evolution of planets and other bodies in our solar system and how datasets inform about these processes.

The deep track delivers a high-level education in quantitative methods and enables students to leverage the full range of diverse data sources available, including data related to missions in which ETH Zurich is currently involved in, such as OSIRIS-REx, InSight, BepiColombo, and LunarLeaper.

A Bachelor in Earth Science or Physics is advised, but the course list also contains specific courses that allow applicants e.g., with engineering degrees to close gaps.

The courses in this deep track are not categorised into mandatory or elective courses. In collaboration with their tutor, students set up a personalised learning agreement tailored to their academic interests and career goals. Students will choose deep track courses for specialised knowledge (at least 20 credits) and elective courses (at least 16 credits) to further explore and deepen their knowledge in diverse disciplines.

Students are encouraged to choose the elective courses from the programme's course list. However, they also have the option to select courses from the entire catalogue of ETH Zurich and the University of Zurich.

Planetary Science courses (minimum of 20 credits)

Number	Title	Semester	ECTS
103-0187-01	Space Geodesy	HS	6 KP
651-3440-02	Geophysics III	HS	4 KP
651-3521-00	Tectonics	HS	3 KP
651-4015-00	Earthquakes I: Seismotectonics	HS	3 KP
651-4025-00	Rock Mechanics and Rock Engineering	HS	4 KP
651-4037-00	Mineral Resources I	HS	3 KP
651-4041-00	Sedimentology I: Physical Processes and Sedimentary Systems	HS	3 KP

Number	Title	Semester	ECTS
651-4055-00	Analytical Methods in Petrology and Geology	HS	3 KP
651-4130-00	Mathematical Concepts in Geophysics	HS	3 KP
651-4233-00	Composition and Evolution of the Earth and Planets	HS	2 KP
651-4241-00	Numerical Modelling I and II: Theory and Applications	HS	6 KP
651-5107-00	Physics of Planetary Interiors	HS	3 KP
651-7102-00	Introduction to Astrobiology (UZH)	HS	5 KP
701-0475-00	Atmospheric Physics	HS	2 KP
701-1241-00	Atmospheric Remote Sensing	HS	3 KP
701-1271-00	Statistical Learning for Atmospheric and Climate Science	HS	3 KP
103-0178-00	Geodetic Earth Monitoring	FS	6 KP
252-0220-00	Introduction to Machine Learning	FS	8 KP
402-0368-13	Extrasolar Planets	FS	6 KP
402-0265-00	Astrophysics III	FS	10 KP
651-4006-00	Seismic Waves I	FS	3 KP
651-4013-00	Potential Field Theory	FS	3 KP
651-4096-00	Inverse Theory I	FS	3 KP
651-4110-00	Computational Methods in Seismic Data Analysis and Imaging	FS	3 KP
651-4228-00	Topics in Planetary Sciences	FS	3 KP
651-4278-00	Monitoring the Earth from Satellites: Radar Interferometry	FS	3 KP
651-7111-00	Biosignatures and Life Detection (UZH)	FS	2 KP
701-0478-00	Introduction to Physical Oceanography	FS	3 KP
701-1216-00	Weather and Climate Modelling	FS	3 KP
701-1270-00	High Performance Computing for Weather and Climate	FS	3 KP

4.4 Deep track Robotics

The deep track Robotics makes use of ETH Zurich's excellent record in robotics, systems, and control. It offers courses in autonomy, control, mobility, computer vision, and human-robotic interfaces. Students will have the opportunity to work with experts on projects covering the entire spectrum, from autonomous exploration in extraterrestrial environments to control of rocket propulsion. Students are expected to have a strong background in mathematics, modelling, and control or be willing to attend extra lectures to fill potential gaps.

The courses in this deep track are not categorised into mandatory or elective courses. In collaboration with their tutor, students set up a personalised learning agreement tailored to their academic interests and career goals. Students will choose deep track courses for specialised knowledge (at least 20 credits) and elective courses (at least 16 credits) to further explore and deepen their knowledge in diverse disciplines.

Students are encouraged to choose the elective courses from the programme's course list. However, they also have the option to select courses from the entire catalogue of ETH Zurich and the University of Zurich.

Robotics courses (minimum of 20 credits)

Number	Title	Semester	ECTS
151-0323-00	Hands-on Self-Driving Cars with Duckietown	HS	4 KP
151-0325-00	Planning and Decision Making for Autonomous Robots	HS	4 KP
151-0371-00	Advanced Model Predictive Control	HS	4 KP
151-0563-01	Dynamic Programming and Optimal Control	HS	4 KP
151-0615-00	Real-World Robotics - A Hands-On Project Class	HS	4 KP
151-0632-00	Vision Algorithms for Mobile Robotics (UZH)	HS	6 KP
151-0851-00	Robot Dynamics	HS	4 KP
151-1116-00	Introduction to Aircraft and Car Aerodynamics	HS	4 KP
151-0623-00	ETH Zurich Distinguished Seminar in Robotics, Systems and Controls	HS	1 KP
227-0124-00	Embedded Systems	HS	6 KP
227-0447-00	Image Analysis and Computer Vision	HS	6 KP
227-0560-00	Computer Vision and Artificial Intelligence for Autonomous Cars	HS	6 KP
227-0689-00	System Identification	HS	4 KP
252-0535-00	Advanced Machine Learning	HS	10 KP
252-3110-00	Human Computer Interaction	HS	8 KP
263-5210-00	Probabilistic Artificial Intelligence	HS	8 KP
263-5902-00	Computer Vision	HS	8 KP
376-1504-00	Physical Human Robot Interaction (pHRI)	HS	4 KP
151-0534-00	Advanced Dynamics	FS	4 KP
151-0566-00	Recursive Estimation	FS	4 KP
151-0634-00	Perception and Learning for Robotics	FS	4 KP
151-0636-00	Soft and Biohybrid Robotics	FS	4 KP
151-0641-00	Introduction to Robotics and Mechatronics	FS	4 KP
151-0660-00	Model Predictive Control	FS	4 KP
151-0854-00	Autonomous Mobile Robots	FS	5 KP
151-9904-00	Applied Category Theory for Engineering II	FS	4 KP
151-1115-00	Aircraft Aerodynamics and Flight Mechanics	FS	4 KP
227-0207-00	Nonlinear Systems and Control	FS	6 KP
227-0518-10	Design and Control of Electric Machines	FS	6 KP
227-0690-13	Robust Control and Convex Optimisation	FS	4 KP
252-0220-00	Introduction to Machine Learning	FS	8 KP
252-0312-00	Mobile Health and Activity Monitoring	FS	6 KP
252-0579-00	3D Vision	FS	5 KP
263-3710-00	Machine Perception	FS	8 KP
263-5806-00	Digital Humans	FS	8 KP
376-1217-00	Rehabilitation Engineering I: Motor Functions	FS	4 KP

4.5 Deep track Space Communication

The deep track Space Communication teaches the fundamentals and recent developments in communication systems for space applications.

The track is built around a newly designed dedicated lecture in the third semester. Leading towards this lecture are the fundamentals in information and communication theory, as well as radio frequency (RF) electronics, optical communications, antenna design, link-budget analysis, modulation, coding, and beamforming. The most important use cases, such as low Earth orbit (LEO) downlink, LEO constellations, geostationary orbit (GEO) data relay, and deep space are discussed.

The track is recommended for students with a Bachelor's degree in Physics or Electrical Engineering. Applicants from other fields may need to complete additional introductory courses.

Space Communication courses (minimum 20 credits)

Number	Title	Semester	ECTS
227-0121-00	Communication Systems	HS	6 KP
227-0301-00	Optical Communication Fundamentals	HS	6 KP
227-0443-00	Space Communications	HS	4 KP
227-0438-00	Wireless Communications	FS	6 KP
227-0120-00	Communication Networks	FS	6 KP

Recommended elective courses (minimum of 16 credits)

Number	Title	Semester	ECTS
227-0417-00	Information Theory I	HS	6 KP
227-0146-00	Data Conversion System Design	HS	6 KP
227-0116-00	VLSI 1: HDL Design Based FPGAs	HS	6 KP
252-1411-00	Security of Wireless Networks	HS	6 KP
402-0448-01	Quantum Information Processing I: Concepts	HS	5 KP
227-0418-00	Algebra and Error Correcting Codes	FS	6 KP
227-0104-00	Communication and Detection Theory	FS	6 KP
227-0111-00	Communications Electronics	FS	6 KP
227-0112-00	High-Speed Signal Propagation	FS	6 KP
252-0220-00	Introduction to Machine Learning	FS	8 KP

5 Doctorate

Unlike at many other universities, the doctorate at ETH Zurich is not organised via an overarching doctoral school. ETH Zurich mainly offers individual doctorates. Each potential doctoral thesis supervisor recruits their doctoral students themselves. In order to be able to complete a doctorate at ETH Zurich, an ETH professor must be willing to supervise your dissertation.

With few exceptions, doctorates are linked to a position at ETH Zurich or within the ETH-domain. The best way to apply for a doctoral position is to contact the professorship you are interested in directly. To do so, visit the website of the department where you would like to do your doctorate and contact the professors you are considering.

Formal ordinances concerning the doctorate are given by ETH Zurich rules of procedure.

↗ ethz.ch/en/doctorate

6 Further information

The following are sources of information concerning the general study programme and study planning at ETH Zurich.

6.1 General information

Earth Sciences student association

The Earth Sciences student association (erfa) organises student events and represents students' interests in the Teaching Commission, Grading Conference, and Department Conference.

↗ erfa.ethz.ch

Personal email address

All students receive a personal email address following admission to a study programme. Academic Services, the department, and lecturers communicate important information via email. Students should use the ETH email address for all communication and check it regularly.

↗ ethz.ch/students/en/service/it-services

ETH Zurich course catalogue

The course catalogue of ETH Zurich provides comprehensive information about the study programmes and procedures as well as an up-to-date online course catalogue. Furthermore, the contents and goals of specific lectures, exercises, and laboratory courses can be accessed.

↗ www.vorlesungen.ethz.ch

Information about the Department of Earth and Planetary Sciences

The website of the Department of Earth and Planetary Sciences contains general information about the department, study regulations and forms, an events calendar, and information about excursions and field courses.

↗ eaps.ethz.ch/en/

6.2 Study advice

6.2.1 Study Administration and Study Coordination

Study Administration

For administrative questions concerning requests to the Director of Studies, grade administration as well as requests to postpone military service. Appointment required.

Mirjam Kandler, Department of Earth and Planetary Sciences

lehre@eaps.ethz.ch

Stephen Arpagaus, Department of Earth and Planetary Sciences

lehre@eaps.ethz.ch

Consultation hours by appointment. Please contact us by email.

Study Coordination

For requests regarding the study programmes, for admission enquiries or for general questions regarding the curriculum as well as transfer of credits. Appointment required.

Karin Mellini, Department of Earth and Planetary Sciences

karin.mellini@eaps.ethz.ch

Scientific Programme Coordinator

For information and advice on subject combinations, specialisations, and learning agreement. Appointment required.

Dr. Simon Stähler, Institute of Geophysics

simon.staehler@eaps.ethz.ch

Director of Studies

Prof. Dr. Heather Stoll, Geological Institute

heather.stoll@eaps.ethz.ch

6.3 Useful links

Student portal

The student portal is the main platform for students, where answers can be found to all study-related questions, like administrative matters, performance assessment, legal actions, or points of contact when facing challenges during studies.

↗ ethz.ch/students/en

Academic Services of ETH Zurich

↗ ethz.ch/en/the-eth-zurich/organisation/departments/academic-services

Application for a study programme at ETH Zurich

↗ eapply.ethz.ch

Application for a Master's degree programme

↗ ethz.ch/en/studies/master/application

Application at the University of Zurich

↗ uzh.ch/en/studies/application/apply

Childcare – Foundation kihz

↗ kihz.uzh.ch/en

Counselling and coaching centre

↗ ethz.ch/students/en/counselling

Course catalogue of ETH Zurich

↗ www.vorlesungen.ethz.ch

Documents and forms of the Department of Earth and Planetary Sciences

↗ eaps.ethz.ch/en/studies/documents

Erfa

↗ erfa.ethz.ch

ETH Alumni Association

↗ alumni.ethz.ch/en/

Financial matters

↗ ethz.ch/en/studies/financial

General Ordinance for Performance Assessments at ETH Zurich

↗ www.fedlex.admin.ch/eli/cc/2012/446/de

Housing

↗ www.wohnen.ethz.ch/en

Legal action

↗ ethz.ch/students/en/studies/legal-action

Military service and studying

↗ ethz.ch/students/en/studies/administrative/militaerdienst

Module Mobility at UZH - Registering for studies at more than one university.

↗ uzh.ch/en/studies/application/chmobilityin

myStudies help

↗ ethz.ch/applications/teaching/en/applications/mystudies

Performance assessments

↗ ethz.ch/students/en/studies/performance-assessments

Plagiarism

↗ ethz.ch/students/en/studies/performance-assessments/plagiarism

Psychological Counselling Services

↗ www.pbs.uzh.ch/en

Student Services

↗ ethz.ch/en/the-eth-zurich/organisation/departments/student-services

Student Exchange Office

↗ ethz.ch/en/the-eth-zurich/organisation/departments/academic-services/student-exchange-office

Studying with special needs

↗ ethz.ch/en/studies/special-study-situations/studying-with-a-disability

Teacher Training (Didaktische Ausbildung)

↗ ethz.ch/de/studium/didaktische-ausbildung

Learning agreement (Master in Space Systems)

This template may be used as a draft for your learning agreement. The official learning agreement is entered in myStudies and must be approved by the tutor of your chosen deep track.

My deep track . . . . . .

Courses within the learning agreement

Scientific introductory courses, min. 2 out of 6 (min. 8 ECTS)	**ECTS**	**Semester**

Deep track courses (min. 20 ECTS)	**ECTS**	**Semester**

Electives (min. 16 ECTS)	**ECTS**	**Semester**

Compulsory components not to be listed in the learning agreement

Core courses	**ECTS**	**Semester**
Core course 1, 2, and 3	30	HS/FS

Science in Perspective (2 ECTS)	**Semester**

Master's thesis (30 ECTS)	**Semester**

Reminder: Additional requirements must be fulfilled in the first year.

Notes

ETH Zurich
Department of Earth and Planetary Sciences
Sonneggstrasse 5
8092 Zurich

eaps.ethz.ch

digital version