Programme syllabus

An accessible version of the syllabus can be found in the Course and programme directory.

Master's Programme, Aerospace Engineering 120 credits

Masterprogram, flyg- och rymdteknik

Valid for students admitted to the education from autumn 16 (HT - Autumn term; VT - Spring term).

This is a translation of the Swedish, legally binding, programme syllabus.

Programme objectives

The main objective of this programme is to educate skilled engineers for the European aerospace industry and research institutions. The programme is mainly intended for (but not exclusive to) Swedish students and students from European universities with which KTH has exchange agreements. It is a joint effort by several different KTH departments, providing leading expertise in their respective areas of research. The Department of Aeronautical and Vehicle Engineering coordinates the programme and contributes about half of the courses.

Knowledge and understanding

A Master of Science in Aerospace Engineering will:

1.have a good ability to independently apply mathematics and basic engineering science in the field of aerospace engineering,

2. be able to formulate and approach new problem settings in a scientific manner, by having a creative, critical and systematic attitude to engineering practice.

Skills and abilities

A Master of Science in Aerospace Engineering will be able to:

1.work out solution strategies to real engineering problems, knowing the capabilities and limitations of different methods and tools,

2.plan, perform and evaluate basic experimental testing in order to investigate the validity of a theoretical model,

3.work efficiently in a teamwork environment in groups with different compositions,

4.work efficiently in an international environment, in particular where English is the professional language,

5.communicate results and conclusions in a competent and intelligible manner, both orally and in writing,

6.follow and participate in aerospace research and development.

Ability to make judgements and adopt a standpoint

A Master of Science in Aerospace Engineering will be able to:

1. critically judge a situation and in an independent manner acquire the information and knowledge that is necessary to establish a qualified standpoint,

2. have the ability to identify the need for further knowledge in the field and take responsibility for keeping their personal knowledge up to date.

Complete information on the degree requirements can found at the local regulation for qualifications at first- and second cycle: www.kth.se

Extent and content of the programme

Aerospace Engineering is a two-year (120 university credits) master programme on the advanced level (second cycle). The instruction language is entirely in English. The programme consists of a basic curriculum followed by four different specializations/tracks in aeronautics, space, lightweight structures or systems engineering. The courses in the basic curriculum are compulsory and

constitutes about one third of the course work. In each specialization there is an additional set of compulsory courses to ensure that the students are qualified to perform a final Master's degree project, Second cycle, 30 university credits.

Eligibility and selection

Basic eligibility requirements

A completed Bachelor's degree, equivalent to a Swedish Bachelor's degree (180 university credits), from a university recognized by government or accredited by other recognized organization. A good knowledge of written and spoken English. Applicants must provide proof of their proficiency in English.

Specific eligibility requirements

The applicant must have a basic degree, Bachelor's or similar, from an aeronautical, mechanical engineering, or similar programme with sufficient theoretical depth and good academic results. Course work must include multivariable calculus, linear algebra, numerical analysis, ordinary differential equations, rigid body mechanics, solid mechanics, and fluid mechanics.

Selection process

The selection process is based on the following selection criteria: University, previous studies (for instance GPA), motivation for the studies (for instance letter of motivation, references).

The evaluation scale is 1-75.

Courses on topics such as complex analysis, partial differential equations, thermodynamics, and control theory are considered an additional qualification. The applicant may get a lower evaluation score if a filled-in program-specific summary sheet is missing from the application documents.

The selection process is based on the following selection criteria: University, previous studies (for instance GPA), motivation for the studies (for instance letter of motivation, references).

The evaluation scale is 1-75.

Courses on topics such as complex analysis, partial differential equations, thermodynamics, and control theory are considered an additional qualification. The applicant may get a lower evaluation score if a filled-in program-specific summary sheet is missing from the application documents.

Implementation of the education

Structure of the education

The academic year at KTH is divided into four periods. Each period lasts approximately seven weeks with at least 33 days of study. Each period is followed by an exam period consisting of two extra days and at least five exam days. In addition to the four regular exam periods, there are three additional re-examination periods: after Christmas, after May and immediately preceding the first study period of the academic year.

The academic year lasts for a duration of 40 weeks. Teaching activities may, if necessary, be scheduled outside the academic year.

In order to give a broad and interesting introduction to the field, the first semester consists of one introductory course in each major discipline (aeronautics, space, lightweight structures and systems engineering, respectively). The second semester offers a number of more advanced courses, that depends on the chosen specialization. Finally, the second year mainly consists of elective courses and the final degree project, second cycle, 30 university credits.

Courses

The programme is course-based. Lists of courses are included in appendix 1.

The programme is course-based. Lists of courses are included in Appendix 1.

The basic curriculum adds up to 35 university credits. In each track, there is an additional set of two, three or four compulsory courses, corresponding to approximately 25 university credits. This leaves approximately 30 university credits for optional (elective) courses. The optional courses should be on the advanced level, and preferably be related to aerospace engineering.

Appendix 1 Basic Curriculum

The basic curriculum consists of a set of courses to enhance basic skills and give an introduction to the different specialisations/tracks. The following courses are compulsory and form the basic curriculum:

Lightweight Structures and FEM

Fundamentals of Flight

Fundamentals of Spaceflight

Systems Engineering

Theory and Methodology of Science (Natural and Technological Science)

The course Fundamentals of Spaceflight includes 3 credits of Theory and Methodology of Science.

In each track, there is an additional set of compulsory courses according to:

Aeronautics:

Flight Mechanics

Aircraft aerodynamics

Aeroelasticity

Space:

Space Physics

Space Environment and Spacecraft Engineering Spacecraft Dynamics

Systems Integration for Space Technology, Part 1 and 2

Lightweight Structures:

Fibre Composites – Materials and Manufacturing Fibre Composites – Analysis and Design Process Process Modelling for Composite Manufacturing

Structural Optimization and Sandwich Design

Systems Engineering:

Applied Linear Optimization

Optimal Control Theory

Control Theory and Practice, Advanced Course

Grading system

Courses in the first and the second cycle are graded on a scale from A to F. A-E are passing grades, A is the highest grade. The grades pass (P) and fail (F) are used for courses under certain circumstances.

Courses in the first and the second cycle are graded on a scale from A to F. A-E are passing grades, A is the highest grade. The grades pass (P) and fail (F) are used for degree project.

Conditions for participation in the programme

Course application

As a student at KTH programmes you have to apply for semester courses. The application is done via universityadmission.se

Semester registration

Everyone admitted to an educational programme at KTH must register for the semesters they intend to study. Semester registration is a prerequisite and is required for the registration and reporting of results on courses. You can carry out a web registration at the same time as the semester starts, provided that you have fulfilled requirements for the coming semester.

Recognition of previous academic studies

Under certain circumstances, and in agreement with the programme director, credits for previous studies can be received according to the local policy of KTH.

Studies abroad

After approval by the programme director, part of the studies may be carried out abroad (including the Master's degree project). The condition is that the parts of the programme carried out abroad should fit in with the educational programme.

Degree project

Students admitted to the programme are required to perform an independent study in the form of a degree project corresponding to 30 university credits, second cycle. To begin the degree project, a student must have completed at least 60 university credits of the total course work and at least two of the three compulsory courses in the specialization.

The purpose of the degree project is that the student should demonstrate the ability to perform independent project work, using and developing the skills obtained from the courses in the programme. The degree project can either be performed at a university or, more commonly, at a company in the aerospace sector with suitable infrastructure to provide sufficient supervision and resources for the project. The student must actively search for a suitable degree project; however KTH will provide some assistance with information on suitable points of contact. Exchange students are recommended to find a degree project in their country of permanent residence or in the country where they intend to start their professional careers.

Degree

In order to earn Degree of Master of Science in Mechanical Engineering (120 credits), passing grades in all courses which are included in the student's study plan are required. The study plan must comprise 120 higher education credits which include a degree project consisting of 30 higher education credits, in the second cycle.

KTH's local degree ordinance can be found at KTH's website, www.kth.se.

Application for degree certificate

Students shall apply for a degree through the web service by logging into your Personal menu /Applications for degrees at www.kth.se

Appendix 1 - Course list
Appendix 2 - Programme syllabus descriptions

Appendix 1: Course list

Master's Programme, Aerospace Engineering (TAEEM)

General courses

Year 1

Mandatory courses (35.0 Credits)

Code	Name	Credits	Edu. level
AK2030	Theory and Methodology of Science (Natural and Technological Science)	4.5 hp	Second cycle
SD2411	Lightweight Structures and FEM	8.0 hp	Second cycle
SD2601	Fundamentals of Flight	7.5 hp	Second cycle
SD2900	Fundamentals of Spaceflight	7.5 hp	Second cycle
SF2863	Systems Engineering	7.5 hp	Second cycle

Supplementary information

Theory and Methodology of Natural and Technological Science: the course SD2900 Fundamentals of Spaceflight, 7,5 credits, contents 3 credits of applied methodological theory – and with the course AK2030 Theory and Methodology of Science (Natural and Technological Science) 4,5 credits - the courses together content 7,5 credits of theory and methodology of natural and technological science.

The course AK2030 Theory and Methodology of Science (Natural and Technological Science) 4,5 credits, is given in several study periods during the academic year. If you want to read the course another study period - please ask the Course Responsible if it is possible.

Year 2

Supplementary information

Mandatory course, Study Year 2, Spring semester: Degree project, Second cycle, 30 credits, a independant project within the track/specialisation:

- **Aeronautics: SD281X.** Track responsible: Ulf Ringertz
- **Lightweight Structures: SD241X.** Track responsible: Stefan Hallström
- **Space: EF233X.** Track responsible: Nickolay Ivchenko
- **Systems Engineering: SF281X.** Track responsible: Per Enqvist

Aeronautics (FLT)

Year 1

Mandatory courses (15.0 Credits)

Code	Name	Credits	Edu. level
SD2801	Aircraft Aerodynamics	6.0 hp	Second cycle
SD2805	Flight Mechanics	9.0 hp	Second cycle

Optional courses

Code	Name	Credits	Edu. level
EL2520	Control Theory and Practice, Advanced Course	7.5 hp	Second cycle
SD2905	Human Spaceflight	7.5 hp	Second cycle
SD2910	Spacecraft Dynamics	9.0 hp	Second cycle
SG2212	Computational Fluid Dynamics	7.5 hp	Second cycle
SG2215	Compressible Flow	7.5 hp	Second cycle

Year 2

Mandatory courses (9.0 Credits)

Code	Name	Credits	Edu. level
SD2810	Aeroelasticity	9.0 hp	Second cycle

Optional courses

Code	Name	Credits	Edu. level
EH2720	Management of Projects	7.5 hp	Second cycle
MJ2241	Jet Propulsion Engines, General Course	6.0 hp	Second cycle

Supplementary information

Please note that the courselist for Study year 2, the academic year 2017/2018 is preliminar.

Mandatory course, Study year 2, Spring semester: Degree project, Second cycle, 30 credits, within the track/specialisation: Aeronautics: SD281X. Trackresponsible: Ulf Ringertz.

Lightweight Structures (LKR)

Year 1

Mandatory courses (12.0 Credits)

Code	Name	Credits	Edu. level
SD2413	Fibre Composites - Analysis and Design	6.0 hp	Second cycle
SD2414	Fibre Composites - Materials and Manufacturing *For students who has not done Degree project, first level, in Lightweight Structures.*	6.0 hp	Second cycle

Optional courses

Code	Name	Credits	Edu. level
SD2432	Lightweight Design	20.0 hp	Second cycle

	The course starts in spring semester (10cr) and continues in autumn semester (10cr).		
SE2129	Fracture Mechanics and Fatigue	9.0 hp	Second cycle

Year 2

Mandatory courses (12.0 Credits)

Code	Name	Credits	Edu. level
SD2415	Process Modelling for Composite Manufacturing	6.0 hp	Second cycle
SD2416	Structural Optimisation and Sandwich Design	6.0 hp	Second cycle

Optional courses

Code	Name	Credits	Edu. level
EH2720	Management of Projects	7.5 hp	Second cycle
HL2035	Biomechanics and Neuronics	7.5 hp	Second cycle
SD2432	Lightweight Design	20.0 hp	Second cycle
SD2810	Aeroelasticity	9.0 hp	Second cycle

Supplementary information

Please note that the courselist for the academic year 2017/2018 is preliminar.

About course SD2432: The course starts in spring semester (10cr) and continues in autumn semester (10cr).

Mandatory course, Study Year 2, Spring semester: Degree project, Second cycle, 30 credits, within the track/specialisation: Structures: SD241X. Track responsible: Stefan Hallström.

Space (RMD)

Year 1

Mandatory courses (12.0 Credits)

Code	Name	Credits	Edu. level

SD2910	Spacecraft Dynamics	9.0 hp	Second cycle
SD2920	System Integration for Space Technology, Part 1	3.0 hp	Second cycle

Optional courses

Code	Name	Credits	Edu. level
AH2923	Global Navigation Satellite Systems (GNSS)	7.5 hp	Second cycle
EL2520	Control Theory and Practice, Advanced Course	7.5 hp	Second cycle
MJ2246	Rocket Propulsion	6.0 hp	Second cycle
SD2805	Flight Mechanics	9.0 hp	Second cycle
SD2905	Human Spaceflight	7.5 hp	Second cycle
SG2215	Compressible Flow	7.5 hp	Second cycle

Year 2

Mandatory courses (15.0 Credits)

Code	Name	Credits	Edu. level
EF2240	Space Physics	6.0 hp	Second cycle
EF2260	Space Environment and Spacecraft Engineering	6.0 hp	Second cycle
SD2925	System Integration for Space Technology, Part 2	3.0 hp	Second cycle

Optional courses

Code	Name	Credits	Edu. level
AG1321	Remote Sensing Technology	7.5 hp	First cycle
EF2200	Plasma Physics	6.0 hp	Second cycle
EF2245	Space Physics II	7.5 hp	Second cycle
EH2720	Management of Projects	7.5 hp	Second cycle
EL2620	Nonlinear Control	7.5 hp	Second cycle

Supplementary information

Please note that the courselist for the academic year 2017/2018 is preliminar.

Mandatory course, Study Year 2, Spring semester: Degree project, Second cycle, 30 credits, within the track/specialisation: Space: EF233X. Track responsible: Nickolay Ivchenko.

Systems Engineering (SYS)

Year 1

Mandatory courses (22.5 Credits)

Code	Name	Credits	Edu. level
EL2520	Control Theory and Practice, Advanced Course	7.5 hp	Second cycle
SF2812	Applied Linear Optimization *Entry requirements: a Course in Optimization.*	7.5 hp	Second cycle
SF2852	Optimal Control Theory	7.5 hp	Second cycle

Optional courses

Code	Name	Credits	Edu. level
EL2450	Hybrid and Embedded Control Systems	7.5 hp	Second cycle
SD2905	Human Spaceflight	7.5 hp	Second cycle
SF2822	Applied Nonlinear Optimization	7.5 hp	Second cycle
SF2842	Geometric Control Theory	7.5 hp	Second cycle

Supplementary information

The course SF2812 Applied Linear Optimization, 7,5hp/credits - Entry requirements: a Course in Optimization: SF1811 Optimization, 6hp/credits, in Autumn study period 2 **in English**. (SF1861 Optimization, 6hp/credits, in Spring study period 4 in Swedish).

Year 2

Optional courses

Code	Name	Credits	Edu. level
EH2720	Management of Projects	7.5 hp	Second cycle
EL2620	Nonlinear Control	7.5 hp	Second cycle

EL2820	Modelling of Dynamical Systems	7.5 hp	Second cycle
SF2832	Mathematical Systems Theory	7.5 hp	Second cycle
SF2866	Applied Systems Engineering	7.5 hp	Second cycle

Supplementary information

Please note that the courselist for the academic year 2017/2018 is preliminar.

Mandatory course, Study Year 2, Spring semester: Degree project, Second cycle, 30 credits, within the track/specialisation: Systems: SF281X. Track responsible: Per Enqvist.

Appendix 2: Specialisations

Master's Programme, Aerospace Engineering (TAEEM)

Aeronautics (FLT)

The aeronautics track focuses on modeling, analysis and design of aircraft. The overall objectives are that the student should be able to design and estimate the performance of an aircraft, compute its aerodynamic properties, simulate its motion in flight, and analyze how the aerodynamic and structural properties influence stability and control. The track is characterized by a strong interaction between theory and practice, and the student will plan, perform and evaluate several wind tunnel tests during the education. An engineer with this profile is particularly attractive to companies working in aerodynamics and aeronautics.

Lightweight Structures (LKR)

The Lightweight Structures track focuses on analysis and development of lightweight materials and structures for more efficient solutions and products. Reduced structural weight can be used for improved structural efficiency, more cost effective production and maintenance, and reduced environmental impact. Emphasis is put on fiber composites, non-metallic materials and sandwich structures, often used in applications with extreme requirements. Students following the track develop knowledge and skills in analysis, design, optimization, materials, manufacturing and testing of lightweight structures. Design of fibre composites call for a systems approach to the choice of materials, manufacturing processes and product solutions, preparing students for future roles as engineers working with development of new products or applications. There is a constant need for skilled structural engineers within aerospace-, naval- and automotive engineering, as well as in smaller businesses working with e.g. more niched manufacturing or innovative design solutions.

Space (RMD)

Space technology plays a key role in modern society, enabling telecommunication and navigation services, weather forecasting, Earth observation and much more. The space track focuses on applications related to rocket and satellite technology, with particular emphasis on propulsion, trajectory analysis, spacecraft dynamics and system perspective. The space environment and its impact on the design and instrumentation of satellites is another central theme in the education. Wider perspective is offered by courses in human spacecraft, space research etc. The space track can conveniently be combined with (parts of) the other tracks in the program to create an attractive competence profile. As a space engineer you can for example work with development, testing and operation of satellites, launchers, sounding rockets or other space systems.

Systems Engineering (SYS)

Aircrafts, trains and satellites are examples of complex systems that have to be designed with reliable controlsystems and efficient maintenance plans to be competitive in today's global market. The overallobjective with the systems track is that you should be able to develop mathematical models ofsystems in order to analyze and optimize their performance. Control theory had a crucial role in thedevelopment of rockets, and has since improved robustness and performance of modern airplanes. Today, it is becoming an increasingly important factor in other areas such as the automotive industryand communications systems. A systems engineer could be working with the design of the control ofthe damping in an aircraft landing gear, or on how to find the least costly spare parts managementsystem or analyzing the reliability of a radar system. A systems engineer is attractive to a largenumber of industries in various fields.