



Programme syllabus

[An accessible version of the syllabus can be found in the Course and programme directory.](#)

Master's Programme, Electromagnetics, Fusion and Space Engineering, 120 credits 120 credits

Masterprogram, elektromagnetism, fusion och rymdteknik

Valid for students admitted to the education from autumn 20 (HT - Autumn term; VT - Spring term).

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

Programme objectives

The Master's programme in Electromagnetics, Fusion and Space Engineering is focused on the study of electromagnetic fields and their application for solving some of the engineering challenges of our future societies. Physical principles, mathematical methods, and numerical models make up the core of the programme, providing the tools and skills needed to describe electromagnetic processes and synthesize complex systems that can nowadays be used to solve engineering problems in space technology, communication systems and fusion energy.

After the completion of the programme, participants are expected to find an industrial or research career in areas such as electromagnetic engineering, antenna design, microwave and THz technology, optical communications, plasma theory, magnetohydrodynamics, fusion physics and technology, and space physics and instrumentation.

Knowledge and understanding

For the Master's degree, the student shall

- demonstrate thorough knowledge about the physical foundation and common practice of microwave, optical, fusion and space technology,
- be able to identify electrophysical problems in various technical systems and natural phenomena, and place them in a larger context, and
- be able to describe technological processes and natural phenomena using mathematical models and commercial software as well as, assess the applicability and limitations of the models.

Skills and abilities

For the Master's degree, the student shall

- critically select and apply analytical and numerical methods to solve problems in electromagnetics, fusion and space engineering,
- demonstrate the ability to critically and systematically integrate knowledge and analyse, assess and deal with complex phenomena, issues and situations even with limited information,
- demonstrate the ability to identify and formulate issues critically, autonomously and creatively as well as to plan and, using appropriate methods, undertake advanced tasks within predetermined time frames and thereby contribute to the creation of knowledge as well as the ability to evaluate this work
- demonstrate the ability to clearly report and discuss his or her conclusions and the knowledge and arguments on which they are based in dialogue with different audiences, both orally and in writing, and
- demonstrate the skills required for participation in research and development work or autonomous employment in some other qualified capacity.

Ability to make judgements and adopt a standpoint

For the Master's degree, the student shall

- demonstrate the ability to make assessments in the field of electromagnetics, fusion and space engineering, informed by relevant disciplinary, social and ethical issues and also to demonstrate awareness of ethical aspects of research and development work
- demonstrate insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used, and
- demonstrate the ability to identify the personal need for further knowledge and take responsibility for his or her ongoing learning.

Extent and content of the programme

The programme consists of 120 credits, corresponding to two years of full-time studies, and the courses are at the second cycle level. The language of instruction throughout the programme is English.

The programme includes the following subject areas:

- Microwave Engineering
- Photonics
- Plasma
- Space

Eligibility and selection

Admission requires the fulfillment of basic eligibility and the following requirements for special eligibility:

- Previous education must include at least 60 higher education credits (corresponding to 12 months of full time studies) within electrical engineering, physics, electronics, or computer science, including courses in basic electromagnetics and mechanics.
- Previous education must also have included basic mathematics courses corresponding to at least 30 higher education credits (corresponding to 6 months of full time studies) of course work in mathematics including calculus, vector algebra, differential equations and numerical methods.

The number of places in the programme is limited. The selection process is based on the following selection criteria: University, previous studies (for instance GPA, grades in specific subjects and English), motivation for the studies (for instance letter of motivation, references, thesis proposal and relevant work experience). The evaluation scale is 1-75.

Implementation of the education

Structure of the education

Each academic year consists of two semesters which are 20 weeks each, and each semester is further divided into two study periods.

The programme comprises two years of full-time studies (120 higher education credits) including one semester degree project (30 higher education credits). The programme includes 31.5 higher education credits of compulsory courses and specific requirements for the chosen track.

Courses

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

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.

Grading scale is found in the course syllabus.

Conditions for participation in the programme

Participation requires admission to courses within the programme and course registration.

For further studies, special admission requirements for the course are to be fulfilled. Special admission requirements are listed in the respective course syllabus.

Degree project

The degree project is the final part of the education and comprises 30 higher education credits. The project work may begin when special admission requirements for the course are fulfilled.

The degree project should be performed within the area of technology for which the degree is being prepared.

Degree

The degree is called "Teknologie masterexamen", English translation "Degree of Master of Science (120 credits)". The main field of the degree is indicated in the text of the diploma.

Appendix 1 - Course list

Appendix 2 - Programme syllabus descriptions



Appendix 1: Course list

Master's Programme, Electromagnetics, Fusion and Space Engineering, 120 credits (TEFRM)

General courses

Year 1

Mandatory courses (31.5 Credits)

Code	Name	Credits	Edu. level
AK2036	Theory and Methodology of Science with Applications (Natural and Technological Science)	7.5 hp	Second cycle
EF2200	Plasma Physics	6.0 hp	Second cycle
EF2222	The Sustainable Electrophysics Engineer	3.0 hp	Second cycle
EI2405	Classical Electrodynamics	7.5 hp	Second cycle
EI2433	Electrotechnical Modelling	7.5 hp	Second cycle

Supplementary information

Mandatory and conditionally elective courses from one track are elective on all other tracks.

Year 2

Mandatory courses (33.0 Credits)

Code	Name	Credits	Edu. level
EA275X	Degree Project in Electrical Engineering, specialising in Electromagnetics, Fusion and Space Engineering, Second Cycle	30.0 hp	Second cycle
EF2222	The Sustainable Electrophysics Engineer	3.0 hp	Second cycle

Supplementary information

Mandatory and conditionally elective courses from one track are elective on all other tracks.

Track, Microwave Engineering (MIC)

Year 1

Mandatory courses (22.5 Credits)

Code	Name	Credits	Edu. level
EI2400	Applied Antenna Theory	7.5 hp	Second cycle
EI2410	Field Theory for Guided Waves	7.5 hp	Second cycle
SK2814	Microwave Engineering	7.5 hp	Second cycle

Conditionally elective courses

Code	Name	Credits	Edu. level
EI2420	Electromagnetic Wave Propagation	7.5 hp	Second cycle
EI2510	Project in Electromagnetic Engineering	9.0 hp	Second cycle
EK2350	Microsystem Technology	7.5 hp	Second cycle

Supplementary information

The Microwave Engineering track has four mandatory courses, of which three courses are read year one.

Information regarding conditionally elective courses

One of the following conditionally elective courses should be chosen year one or year two.

Year 2

Mandatory courses (7.5 Credits)

Code	Name	Credits	Edu. level
EK2370	Build your own Radar System, Project Course	7.5 hp	Second cycle

Conditionally elective courses

Code	Name	Credits	Edu. level
DD2370	Computational Methods for Electromagnetics	7.5 hp	Second cycle
EI2402	Electromagnetic compatibility	7.5 hp	Second cycle
EI2510	Project in Electromagnetic Engineering	9.0 hp	Second cycle
EK2360	Hands-On Microelectromechanical Systems Engineering	7.5 hp	Second cycle

Supplementary information

The Microwave Engineering track has four mandatory courses, of which one courses are read year two.

Information regarding conditionally elective courses

One of the following conditionally elective courses should be chosen year one or year two.

Track, Photonics (PHS)

Year 1

Mandatory courses (18.0 Credits)

Code	Name	Credits	Edu. level
SK2320	Problem Solving in Optics	6.0 hp	Second cycle
SK2330	Optical Systems Design	6.0 hp	Second cycle
SK2340	Fourier optics	6.0 hp	Second cycle

Conditionally elective courses

Code	Name	Credits	Edu. level
SK2350	Optical Measurement Techniques	6.0 hp	Second cycle
SK2403	Applied Photonics	6.0 hp	Second cycle
SK2411	Laser Physics	7.5 hp	Second cycle

Supplementary information

The Photonics track has five mandatory courses, of which three courses are read year one.

Information regarding conditionally elective courses

One of the following conditionally elective courses should be chosen year one or year two.

Year 2

Mandatory courses (13.5 Credits)

Code	Name	Credits	Edu. level
SK2300	Optical Physics	6.0 hp	Second cycle
SK2402	Fundamentals of Photonics	7.5 hp	Second cycle

Conditionally elective courses

Code	Name	Credits	Edu. level
EI2510	Project in Electromagnetic Engineering	9.0 hp	Second cycle
SK2800	Laser Spectroscopy	8.0 hp	Second cycle
SK2811	Fiber-optical Communication	7.5 hp	Second cycle
SK2902	Light-matter Interaction	7.5 hp	Second cycle

Supplementary information

The Photonics track has five mandatory courses, of which two courses are read year two.

Information regarding conditionally elective courses

One of the following conditionally elective courses should be chosen year one or year two.

Track, Plasma (PLA)

Year 1

Mandatory courses (12.0 Credits)

Code	Name	Credits	Edu. level
ED2200	Energy and Fusion Research	6.0 hp	Second cycle
ED2210	Electromagnetic Waves in Dispersive Media	6.0 hp	Second cycle

Conditionally elective courses

Code	Name	Credits	Edu. level
EI2400	Applied Antenna Theory	7.5 hp	Second cycle
SH2008	Introductory Modern Physics	6.0 hp	Second cycle
SK2402	Fundamentals of Photonics	7.5 hp	Second cycle
SK2814	Microwave Engineering	7.5 hp	Second cycle

Recommended courses

Code	Name	Credits	Edu. level
EF2215	Plasma Physics II	7.5 hp	Second cycle
EF2270	Applied Plasma Physics	6.0 hp	Second cycle

Supplementary information

The Plasma track has four mandatory courses, of which two courses are read year one.

Information regarding conditionally elective courses

Two of the following conditionally elective courses should be chosen year one or year two.

Year 2

Mandatory courses (13.5 Credits)

Code	Name	Credits	Edu. level
EF2215	Plasma Physics II	7.5 hp	Second cycle
EF2270	Applied Plasma Physics	6.0 hp	Second cycle

Conditionally elective courses

Code	Name	Credits	Edu. level
ED2235	Atomic Physics for Fusion	6.0 hp	Second cycle
EF2240	Space Physics	6.0 hp	Second cycle
EF2245	Space Physics II	7.5 hp	Second cycle

Recommended courses

Code	Name	Credits	Edu. level
ED2240	Introduction Course to Fusion Technology	6.0 hp	Second cycle

Supplementary information

The Plasma track has four mandatory courses, of which two courses are read year two.

Information regarding conditionally elective courses

Two of the following conditionally elective courses should be chosen year one or year two.

Track, Space (SPA)

Year 1

Mandatory courses (16.5 Credits)

Code	Name	Credits	Edu. level
AH2923	Global Navigation Satellite Systems (GNSS)	7.5 hp	Second cycle
SD2920	System Integration for Space Technology, Part 1	3.0 hp	Second cycle
SH2402	Astrophysics	6.0 hp	Second cycle

Conditionally elective courses

Code	Name	Credits	Edu. level
EI2400	Applied Antenna Theory	7.5 hp	Second cycle
EI2440	Electrotechnical Design	7.5 hp	Second cycle
SH2008	Introductory Modern Physics	6.0 hp	Second cycle

Supplementary information

The Space track has six mandatory courses, of which three courses are read year one.

Information regarding conditionally elective courses

One of the following conditionally elective courses should be chosen year one or year two.

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

Conditionally elective courses

Code	Name	Credits	Edu. level
AG1321	Remote Sensing Technology	7.5 hp	First cycle
EF2225	Project in Space Physics	12.0 hp	Second cycle
EF2227	Project in Space Technology	12.0 hp	Second cycle
EF2228	Project in Space Technology	15.0 hp	Second cycle
EF2245	Space Physics II	7.5 hp	Second cycle
EI2402	Electromagnetic compatibility	7.5 hp	Second cycle

Supplementary information

The Space track has six compulsory courses, of which three courses are read year two.

Information regarding conditionally elective courses

One of the following conditionally elective courses should be chosen year one or year two.



Appendix 2: Specialisations

Master's Programme, Electromagnetics, Fusion and Space Engineering, 120 credits (TEFRM)

Track, Microwave Engineering (MIC)

As a student in this track, you will acquire knowledge about microwave technology and its application for the design of microwave circuits and components, and antennas. The track is composed of both theoretical and practical courses, and you will learn how to model and design electromagnetic devices.

Track, Photonics (PHS)

The track contains both theoretical and experimental treatment of electromagnetic fields at optical frequencies. There is a wide spectrum of applications including communication, measurements, imaging, energy, and lighting.

Track, Plasma (PLA)

This track is focused on plasma theory and applications, ranging from new industrial plasma processing technologies to research on future fusion energy power plants. Topics included in the track are energy and fusion research, plasma processing, as well as fundamental plasma theory.

Track, Space (SPA)

Space track offers specialisation in space research and applications, ranging from space plasma physics and astrophysics to satellite technology. You will develop an understanding of processes that shape space environment both in the vicinity of the Earth and far away from it, and get an insight into satellite and space system engineering.