



Master's Programme in

# Electromagnetics, Fusion and Space Engineering

The two-year master's programme in Electromagnetics, Fusion and Space Engineering incorporates a strong foundation in electrical engineering with an understanding of electromagnetic fields and how they interact with matter.

Electromagnetic fields are the basis of telecommunications. They are employed, for example, to transmit high-speed data through optic fibres or mobile wireless systems. Additionally, electromagnetic fields are transmitted from objects in the universe, such as stars, and they provide key information to help us understand the universe. Furthermore, a fundamental understanding of plasma is needed for controlling and generating fusion energy, the same source that powers the Sun, and which promises to power the Earth in the near future. With these objectives in mind, our programme is built around four distinct areas of focus:

- Microwave Engineering
- Photonics
- Plasma
- Space

These four areas are defined as four specialized tracks with a common core of selected courses in plasma and electromagnetic theory.

The studies in the master's programme in Electromagnetics, Fusion and Space Engineering are course-based. The academic year is divided into four study periods, and there are typically 2–3 courses running over a 10-

week long study period. Obligatory courses are scheduled in the first two study periods of the programme, with the rest of the courses offered as electives from a wide range of topics.

The programme is set in an international environment, with students from an extensive number of nationalities. World-renowned professors teach all the courses in English. Our variety of pedagogical methods offers plentiful opportunities to develop group communication skills and gain experience in working on mixed teams. The research and industrialization in the fields of communications, space and fusion is developed in international environments. KTH internationally leads a number of projects in space missions within NASA and the European Space Agency (ESA), and the fusion reactor: ITER (International Thermonuclear Experimental Reactor).

### **PARTICIPATE IN RESEARCH**

There are plenty of opportunities to participate in the research and project work at the departments hosting the programme (such as space and plasma physics, electromagnetic engineering and fusion plasma physics). For example, these departments have individual project courses corresponding to eight weeks of work in non-scheduled time that can be transferred into conventional course credits.

### **MASTER'S DEGREE PROJECT**

The degree project carried out in the final term can be undertaken at KTH or in industry. In some cases, parts or the whole project can be completed abroad. Industry-oriented projects offer the possibility of joining Swedish or international companies after the master's thesis. In research-oriented projects, part of the work is often aimed at publication in reputed peer-reviewed journals, providing opportunities to pursue Ph.D. studies at KTH or other top universities or research centres.

### **Examples of degree projects made by former students:**

- Numerical study of spectral densities of fluctuations in thermal plasma
- Graphene growth on SiC under Arambion and H-intercalation
- Efficient computation of the near-field mutual coupling between antennas on vehicles
- Ka-band 2D Luneburg Lens design with a glide-symmetric metasurface
- Analysis of the electric and magnetic fields time variation inside the auroral oval region
- Modelling of collisionless alpha-particle confinement in Tokamaks

### **CAREER**

KTH has an international reputation in plasma physics, and has been the home of Hannes Alfvén, a pioneer in the field and Nobel Prize-winner. Today, the university is active in several aspects of the development of ITER, from plasma modelling to engineering material facing the plasma. Space research at KTH is carried out in both large international projects under ESA and NASA and in smaller collaborations with leading research centres and universities around Europe, USA, South Africa and Japan. Emphasis is placed on both the theoretical and applied aspects of the field with a multidisciplinary approach and close proximity to real research applications – with many master's theses completed in international collaborations. The Electromagnetics, Fusion and Space Engineering programme offers students a unique breadth of experience with a multitude of career prospects following their degree.

### **CONTACT**

Programme Director: Oscar Quevedo Teruel, [oscarqt@kth.se](mailto:oscarqt@kth.se)  
Master Coordinator: Cristina La Verde, [clv@kth.se](mailto:clv@kth.se)

### **READ MORE AND GET IN CONTACT WITH THE STUDENT AMBASSADORS**

[www.kth.se/studies](http://www.kth.se/studies)

		YEAR	CREDITS	1	2	3	4
<b>MANDATORY: ALL TRACKS</b>							
AK2036	Theory and Methodology of Science with Applications	1	7.5	x			
EF2200	Plasma Physics	1	6.0	x			
EF2222	The Sustainable ... Engineer	1-2	3.0	x	x	x	x
EI2405	Classical Electrodynamics	1	7.5		x		
EI2433	Electrotechnical Modelling	1	7.5		x		
	Master thesis	2	30.0			x	x

#### TRACK: MICROWAVE ENGINEERING

The track Microwave Engineering has four compulsory courses. The student shall also chose one of the following conditionally elective courses: EI2510, EI2420, EK2350, EI2410.

##### Mandatory

SK2814	Microwave Engineering	1	7.5			x	
EI2400	Applied Antenna Theory	1	7.5				x
EI2410	Field Theory for Guided Waves	1	7.5				x
EK2360	Hands-On Microelectromech. Systems Engineering	2	7.5		x		

##### Conditionally elective

EI2420	Electromagnetic Wave Propagation	1	7.5			x	
EI2510	Project in Electromagnetic Eng.	1	9.0			x	x
EK2350	Microsystem Technology	1	7.5				x
EI2510	Project in Electromagnetic Eng.	2	9.0	x	x		
EI2402	Electromagnetic compatibility	2	7.5	x			

#### TRACK: PHOTONICS

The track Photonics has five compulsory courses. The student can also chose the following conditionally elective courses: SK2350, SK2400, SK2411, SK2766, EI2510, SK2811.

##### Mandatory

SK2320	Problem Solving in Optics	1	6.0			x	x
SK2340	Fourier optics	1	6.0				x
SK2812	Photonics	1	7.5				x
SK2300	Optical Physics	2	6.0	x			
SK2301	Optical Physics	2	3.0	x			

##### Conditionally elective

SK2350	Optical Measurement Techniques	1	6.0			x	
SK2400	Quantum Electronics with Electro Optics	1	12.0			x	
SK2411	Laser Physics	1	7.5				x
SK2766	Semiconductor- and Nano-Optics	1	6.0				x
EI2510	Project in Electromagnetic Eng.	2	9.0	x	x		
SK2811	Fiber-optical Communication	2	7.5	x			

		YEAR	CREDITS	1	2	3	4
<b>TRACK: PLASMA</b>							
The track plasma has four compulsory courses. The student shall also chose two of the following conditionally elective courses: SH2008, SK2400, EI2400, EF2240, IT2651, EF2245, ED2235.							
<b>Mandatory</b>							
ED2210	Electromagnetic Processes in dispersive media	1	6.0			x	
ED2200	Energy and Fusion research	1	6.0				x
EF2270	Applied plasma physics	1	6.0			x	
EF2215	Plasma Physics II	2	7.5	x			
<b>Conditionally elective</b>							
<i>Choose at least two course</i>							
SK2814	Microwave engineering	1	7.5			x	
SH2008	Introductory Modern physics	1	6.0			x	
EI2400	Applied antenna theory	1	7.5				x
SK2400	Quantum Electronics with Electrooptics	1	12.0			x	
EF2240	Space Physics I	2	6.0	x			
EF2245	Space Physics II	2	7.5		x		
ED2235	Atomic physics for Fusion	2	6.0		x		
<b>TRACK: SPACE</b>							
The track Space has six compulsory courses. The student shall also chose one of the following conditionally elective courses: EI2402, SH2008, EI2440, EI2400, EF2245, AG1321.							
<b>Mandatory</b>							
AH2923	Global Navigation Satellite Systems	1	7.5				x
SH2402	Astrophysics	1	6.0				x
SD2920	System Integration for Space Technology, Part 1	1	3.0			x	x
SD2925	System Integration for Space Technology, Part 2	2	3.0	x	x		
EF2240	Space physics	2	6.0	x			
EF2260	Space environment and spacecraft engineering	2	6.0		x		
<b>Conditionally elective</b>							
<i>Chosse at least one course</i>							
SH2008	Introductory Modern physics	1	6.0			x	
EI2440	Electrotechnical design	1	7.5			x	
EI2400	Applied Antenna Theory	1	7.5				x
EF2245	Space Physics II	2	7.5		x		
AG1321	Remote Sensing Technology	2	7.5	x			
EI2402	Electromagnetic compatibility	2	7.5	x			