



# Programme syllabus

Master's Programme, Systems, Control and Robotics, 120 credits

Masterprogram, systemteknik och robotik

*120.0 credits*

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*Valid for students admitted to the education from autumn 18 (HT - Autumn term; VT - Spring term).*

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

## Programme objectives

The Master's Programme in Systems, Control and Robotics includes courses in analysis, design and control of complex technical systems. Within the program the students will learn the theoretical foundations of modeling, control and optimization of complex systems.

The application areas for systems and control are many, and within the program the student can choose to focus on one of four tracks: robotics and autonomous systems, electric power systems, networked control systems and systems and control theory.

In its interdisciplinary spirit the programme brings together courses from both the School of Electrical Engineering (EES) and the School of Computer Science and Communication (CSC). The students of the programme acquire the knowledge and understanding necessary when working with complex systems in different capacities both in academia and in industry.

## Knowledge and understanding

For the master's degree, the student should:

- have thorough knowledge of current theories and developments in the study area
- have thorough understanding of high competence in Systems and Control
- independently be able to identify and formulate problems related to Systems, Control and Robotics and with adequate methods be able to carry out qualified analysis.

## Skills and abilities

Working with complex systems requires skills and abilities in a wide range of topics. For the master's degree, the student should:

- acquire a broad base of skills in core technical subjects such as signal processing, modeling, control, estimation, and programming, which are key to understanding complex systems
- show ability to understand problems that may not be within their selected area of specialization
- acquire skills in working in projects and the theory and methodology of science.

## Ability to make judgements and adopt a standpoint

Equipped with the above mentioned skills and abilities, an objective is also to make the students able to:

- critically review the work of others and adopt a standpoint in different matters within the technical area
- show the ability to, within the technical area, make judgments with regards to relevant scientific, social, and ethical aspects

- show insight about technology's possibilities and limitations and its role in society
- show the ability to identify his/her need for further knowledge and take responsibility for developing his/her knowledge.

## Extent and content of the programme

The programme is on the second level and comprises 120 higher education credits (equivalent to 120 ECTS) corresponding to two years of full-time studies. The language of instruction throughout the programme is English. The following specialisations are offered:

- Systems and Control Theory
- Networked Control Systems
- Electrical Energy Systems
- Robotics and Autonomous System

Each track defines a number of courses that are compulsory and conditionally elective. In addition to these courses the student must add one or two non-technical courses and optional courses to reach up to 90 credits total in courses and 30 credit degree project. Some of the courses accept a limited number of students and the students have to compete with other students at KTH on these courses. Some courses are not given every year.

## Eligibility and selection

### Basic eligibility

Basic eligibility to be accepted to the master's programme requires that the applicant has a degree on the first level consisting of at least 180 higher education credits or a corresponding foreign degree. In addition, good knowledge in English, oral and written, is required.

### Specific eligibility

Previous education must include basic mathematics courses in linear algebra, calculus in one and several variables, probability theory and computer science. The student must also have taken a course in signals and systems including material about about time-continuous and time-discrete systems, sampling, linear filters and systems, transform methods (Laplace and Z) and a course in control engineering. The above can also be described as the student to have completed courses corresponding to the following of KTH courses:

- SF1624 Algebra and Geometry
- SF1625 Calculus in One Variable
- SF1626 Calculus in Several Variables
- SF1901 Probability Theory and Statistics
- SF1634 Differential Equations II
- EL1110 Automatic Control, General Course
- DD1343 Computer Science and Numerical Methods, part 1

### Selection

The selection process is based on the following selection criteria: University, previous studies (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

The study year for KTH's undergraduate education is divided into two semesters, each with two study periods (four study periods in total over the year). Each study period is followed by an exam period. For detailed information about the academic year please see the KTH student web.

The programme comprises 2 years of full-time studies (120 higher education credits) including a half-year degree project (30 higher education credits). The program begins with a number of compulsory courses in the first year to ensure a certain level of knowledge within the programme's core subjects and thus provide the students with the broad base needed to work with complex systems. The second year, the students specialize their studies in the first half and in the second half the degree project takes place.

## **Courses**

The programme is course-based. Lists of courses are included in [appendix 1](#).

The programme carries out four different tracks, which define a set of mandatory and conditionally elective courses. Students need to complement these courses with one or two non-technical courses and additional elective courses for a total of 90 course credits and 30 credits degree project. Some of the courses have an upper limit for the number of seats and the students must compete with other students at KTH for these seats. Some of the courses do not run every year.

## **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.

The grades pass (P) and fail (F) are also used for the degree project.

Since the grading systems differ between different countries, the grades from studies abroad will not be transferred to the KTH grading system.

## **Conditions for participation in the programme**

Participation requires admission to courses within the programme and course registration. Course registration is done via the personal menu at [www.kth.se](http://www.kth.se). If the student decides not to take a course, then the student should notify the course administrator.

## **Course Selection**

The selection of courses for the coming term must be done by the student via the [www.antagning.se](http://www.antagning.se) with the students KTH-account:

- May 1-15th for the fall term
- November 1-15th for the spring term

## **Conditions for further studies**

For students starting their education from the autumn semester 2018, previous promotion requirements have been replaced with special admission requirements to each course. Admission requirements are specified in the course syllabus.

## **Recognition of previous academic studies**

According to the Swedish Higher Education Ordinance, a student who has gone through certain first-cycle study courses and study programmes with a passing result has the right to have such credit recognised for a corresponding course of education at another institution of higher education. The Program Director for the master's programme in System, Control and Robotics will make the decisions concerning recognition of entire courses. Courses included in a previous degree cannot be recognised. Awards of credits for parts of courses may be decided upon by an examiner.

For further information on recognition of previous academic studies, see the KTH:s regelverk.

## Studies abroad

Exchange studies are available through a number of agreements between KTH and other universities. The Degree project (Master's Thesis project) can be performed abroad providing the student has an advisor and examiner at KTH and an advisor at the receiving institution or company, and that the work follows the KTH regulations for a degree projects.

## 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.

General rules and guidelines for the thesis and grading of the thesis are described in the KTH regulations.

The degree project should be performed within the area of technology for which the degree is being prepared. The degree project is carried out individually and must be within an area corresponding to the courses which the student has taken. Before the degree project is started, it must be approved both by the KTH examiner and the program director.

The degree project is graded according to the P-F scale, using the three bases for assessment common to all grading at KTH: the engineering and scientific content, the process, and the presentation.

## Degree

Students who have completed the two-year Master's programme in Systems, Control and Robotics (120 ECTS) will be able to apply for a "Teknologie masterexamen", translated into English as "Degree of Master of Science (two years)".

To be able to apply for the degree the student has to fulfill the national qualification requirements and have completed courses corresponding to 120 higher education credits including:

- all of the compulsory courses depending on track
- a sufficient number of conditionally elective technical courses depending on the chosen track
- one or two elective non-technical courses
- one project course in the subject area
- other elective courses for a total of 90 higher education credits
- Degree project of 30 higher education credits.

The student applies for their degree via the "Personal Menu" at [www.kth.se](http://www.kth.se).

KTH's local degree ordinance is available in their entirety in the KTH regulatory framework that can be found on the intranet. The main subject for the degree will be stated in the degree certificate .

[Appendix 1 - Course list](#)

[Appendix 2 - Programme syllabus descriptions](#)



# Appendix 1: Course list

Master's Programme, Systems, Control and Robotics, 120 credits (TSCRM), Programme syllabus for studies starting in autumn 2018

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## General courses

### Year 1

#### Mandatory courses (33.0 credits)

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Course code	Course name	Credits	Edu. level
AK2036	Theory and Methodology of Science with Applications (Natural and Technological Science)	7.5	Second cycle
DD2410	Introduction to Robotics	7.5	Second cycle
EL2220	The Sustainable Systems and Control Engineer	3.0	Second cycle
EL2520	Control Theory and Practice, Advanced Course	7.5	Second cycle
EL2820	Modelling of Dynamical Systems	7.5	Second cycle

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#### Recommended courses

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Course code	Course name	Credits	Edu. level
DD2420	Probabilistic Graphical Models	7.5	Second cycle
DD2424	Deep Learning in Data Science	7.5	Second cycle
DD2425	Robotics and Autonomous Systems <i>Project Course</i>	9.0	Second cycle
DD2438	Artificial Intelligence and Multi Agent Systems <i>Project Course</i>	15.0	Second cycle
DH1620	Human-Computer Interaction, Introductory Course <i>Non-technical/merged with DH2620</i>	6.0	First cycle
DT2140	Multimodal Interaction and Interfaces	7.5	Second cycle
EG2210	Electricity Market Analysis	7.5	Second cycle
EH2030	Business Development and Quality Management <i>Non-technical</i>	7.5	Second cycle
EH2720	Management of Projects <i>Non-technical</i>	7.5	Second cycle

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<b>Course code</b>	<b>Course name</b>	<b>Credits</b>	<b>Edu. level</b>
EH2745	Computer Applications in Power Systems	4.5	Second cycle
EL1010	Automatic Control, General Course	6.0	First cycle
EL2222	Systems and Control in Practice	1.5	Second cycle
EL2425	Automatic Control, Project Course, Smaller Course <i>Project Course</i>	7.5	Second cycle
EL2450	Hybrid and Embedded Control Systems	7.5	Second cycle
EL2805	Reinforcement Learning <i>Replaces EL2800</i>	7.5	Second cycle
EP2520	Building Networked Systems Security <i>Project Course</i>	7.5	Second cycle
EQ1220	Signal Theory	7.5	First cycle
EQ2310	Digital Communications	9.0	Second cycle
EQ2321	Speech and Audio Processing	7.5	Second cycle
EQ2871	Cyber-Physical Networking	7.5	Second cycle
II2302	Sensor Based Systems	7.5	Second cycle
IL2206	Embedded Systems	7.5	Second cycle
IL2212	Embedded Software	7.5	Second cycle
LS1419	English for Employment <i>Non-technical</i>	7.5	First cycle
LS1464	Rhetoric - the Art of Persuasion <i>Non-technical</i>	7.5	First cycle
LS2429	Technical Communication in English <i>Non-technical</i>	7.5	Second cycle
LS2439	English for Writing and Presenting a Degree Project in Science and Engineering <i>Non-technical</i>	7.5	Second cycle
ME1003	Industrial Management, Basic Course <i>Non-technical</i>	6.0	First cycle
ME2089	Leadership in Cross-Cultural and Industrial Contexts <i>Non-technical</i>	6.0	Second cycle
MF2007	Dynamics and Motion Control	9.0	Second cycle
MF2030	Mechatronics basic Course	6.0	Second cycle
MF2043	Robust Mechatronics	6.0	Second cycle
SD2231	Applied Vehicle Dynamics Control <i>Project Course</i>	7.5	Second cycle
SF1691	Complex Analysis <i>Replaces SF1628</i>	7.5	First cycle
SF1811	Optimization	6.0	First cycle

Course code	Course name	Credits	Edu. level
SF1861	Optimization	6.0	First cycle
SF2568	Parallel Computations for Large- Scale Problems	7.5	Second cycle
SF2812	Applied Linear Optimization	7.5	Second cycle
SF2832	Mathematical Systems Theory	7.5	Second cycle
SF2842	Geometric Control Theory	7.5	Second cycle
SF2940	Probability Theory	7.5	Second cycle
SF2943	Time Series Analysis	7.5	Second cycle

### Supplementary information

**Course list:** Information is based upon the curriculum for academic year 2017/2018. Changes may occur.

### Requirements for all tracks

- Compulsory courses: EL2820, AK2036, EL2520, EL2220, DD2410
- Select one or two non-technical courses
- Select at least one project course from the study area
- Requirements from one track
- Complement with recommended courses up to 120cr

**NOTE:** Compulsory and conditionally elective courses from one track are recommended on all other tracks.

**NOTE:** A course can only be listed once below and is listed only as compulsory if it is compulsory on one track and only conditionally elective on another. Please use the course list for each separate track for a complete account of the conditionally elective courses.

## Year 2

### Mandatory courses (10.5 credits)

Course code	Course name	Credits	Edu. level
AK2036	Theory and Methodology of Science with Applications (Natural and Technological Science)	7.5	Second cycle
EL2220	The Sustainable Systems and Control Engineer	3.0	Second cycle

### Recommended courses

Course code	Course name	Credits	Edu. level
DD1385	Software Engineering	6.0	First cycle
DD1388	Program System Construction Using C++ <i>Replaces DD1387</i>	7.5	First cycle
DD2352	Algorithms and Complexity	7.5	Second cycle

<b>Course code</b>	<b>Course name</b>	<b>Credits</b>	<b>Edu. level</b>
DD2401	Neuroscience	7.5	Second cycle
DD2420	Probabilistic Graphical Models	7.5	Second cycle
DD2425	Robotics and Autonomous Systems <i>Project Course</i>	9.0	Second cycle
DD2435	Mathematical Modelling of Biological Systems	9.0	Second cycle
DD2438	Artificial Intelligence and Multi Agent Systems <i>Project Course</i>	15.0	Second cycle
DD2447	Statistical Methods in Applied Computer Science	6.0	Second cycle
DD2459	Software Reliability	7.5	Second cycle
DD2464	Bigger Advanced, Individual Course in Computer Science	9.0	Second cycle
DD2476	Search Engines and Information Retrieval Systems	9.0	Second cycle
DH1620	Human-Computer Interaction, Introductory Course <i>Non-technical</i>	6.0	First cycle
DT2140	Multimodal Interaction and Interfaces	7.5	Second cycle
EG2210	Electricity Market Analysis	7.5	Second cycle
EH2030	Business Development and Quality Management <i>Non-technical</i>	7.5	Second cycle
EH2720	Management of Projects <i>Non-technical</i>	7.5	Second cycle
EH2745	Computer Applications in Power Systems	4.5	Second cycle
EL2425	Automatic Control, Project Course, Smaller Course <i>Project Course</i>	7.5	Second cycle
EL2450	Hybrid and Embedded Control Systems	7.5	Second cycle
EL2805	Reinforcement Learning	7.5	Second cycle
EP2520	Building Networked Systems Security <i>Project Course</i>	7.5	Second cycle
EQ2310	Digital Communications	9.0	Second cycle
EQ2321	Speech and Audio Processing	7.5	Second cycle
EQ2401	Adaptive Signal Processing	7.5	Second cycle
EQ2871	Cyber-Physical Networking	7.5	Second cycle
II2302	Sensor Based Systems	7.5	Second cycle
IL2206	Embedded Systems	7.5	Second cycle
IL2212	Embedded Software	7.5	Second cycle
LS1419	English for Employment <i>Non-technical</i>	7.5	First cycle



<b>Course code</b>	<b>Course name</b>	<b>Credits</b>	<b>Edu. level</b>
LS1464	Rhetoric - the Art of Persuasion <i>Non-technical</i>	7.5	First cycle
LS2426	German B2 for Engineers <i>Non-technical</i>	7.5	Second cycle
LS2429	Technical Communication in English <i>Non-technical</i>	7.5	Second cycle
LS2436	French B2 for Engineers <i>Non-technical</i>	7.5	Second cycle
LS2439	English for Writing and Presenting a Degree Project in Science and Engineering <i>Non-technical</i>	7.5	Second cycle
LS2449	Spanish B2 for Engineers <i>Non-technical</i>	7.5	Second cycle
ME1003	Industrial Management, Basic Course <i>Non-technical</i>	6.0	First cycle
ME2089	Leadership in Cross-Cultural and Industrial Contexts <i>Non-technical</i>	6.0	Second cycle
MF2007	Dynamics and Motion Control	9.0	Second cycle
MF2030	Mechatronics basic Course	6.0	Second cycle
MF2043	Robust Mechatronics	6.0	Second cycle
SD2231	Applied Vehicle Dynamics Control <i>Project Course</i>	7.5	Second cycle
SF1691	Complex Analysis <i>Replaces SF1628</i>	7.5	First cycle
SF1811	Optimization	6.0	First cycle
SF1861	Optimization	6.0	First cycle
SF2568	Parallel Computations for Large- Scale Problems	7.5	Second cycle
SF2812	Applied Linear Optimization	7.5	Second cycle
SF2832	Mathematical Systems Theory	7.5	Second cycle
SF2842	Geometric Control Theory	7.5	Second cycle
SF2852	Optimal Control Theory	7.5	Second cycle
SF2940	Probability Theory	7.5	Second cycle
SF2943	Time Series Analysis	7.5	Second cycle

### Supplementary information

**Course list:** Information is based upon the curriculum for academic year 2017/2018. Changes may occur.

### Requirements for all tracks

- Compulsory courses: EL2820, AK2036, EL2520, EL2220, DD2410
- Select one or two non-technical courses
- Select at least one project course from the study area
- Requirements from one track
- Complement with recommended courses up to 120cr

**NOTE:** Compulsory and conditionally elective courses from one track are recommended on all other tracks.

**NOTE:** A course can only be listed once below and is listed only as compulsory if it is compulsory on one track and only conditionally elective on another. Please use the lists above for a complete account of the conditionally elective courses.

## Year 3

### Track, Electrical Energy Systems (ELEM)

#### Year 1

##### Mandatory courses (13.5 credits)

Course code	Course name	Credits	Edu. level
EG2100	Power System Analysis	6.0	Second cycle
EL2450	Hybrid and Embedded Control Systems	7.5	Second cycle

##### Conditionally elective courses

Course code	Course name	Credits	Edu. level
EG2110	Power System Stability and Control	7.5	Second cycle
EH2741	Communication and Control in Electric Power Systems	6.0	Second cycle
EH2745	Computer Applications in Power Systems	4.5	Second cycle
EJ2201	Electrical Machines and Drives	6.0	Second cycle
EJ2301	Power Electronics	6.0	Second cycle
EK2350	Microsystem Technology	7.5	Second cycle
EK2360	Hands-On Microelectromechanical Systems Engineering	7.5	Second cycle
EL2425	Automatic Control, Project Course, Smaller Course	7.5	Second cycle
EL2620	Nonlinear Control	7.5	Second cycle
EL2700	Model Predictive Control	7.5	Second cycle
IS1200	Computer Hardware Engineering	7.5	First cycle

## Year 2

### Conditionally elective courses

Course code	Course name	Credits	Edu. level
EG2110	Power System Stability and Control	7.5	Second cycle
EH2741	Communication and Control in Electric Power Systems	6.0	Second cycle
EH2745	Computer Applications in Power Systems	4.5	Second cycle
EJ2201	Electrical Machines and Drives	6.0	Second cycle
EJ2301	Power Electronics	6.0	Second cycle
EK2350	Microsystem Technology	7.5	Second cycle
EK2360	Hands-On Microelectromechanical Systems Engineering	7.5	Second cycle
EL2425	Automatic Control, Project Course, Smaller Course	7.5	Second cycle
EL2620	Nonlinear Control	7.5	Second cycle
EL2700	Model Predictive Control	7.5	Second cycle
IS1200	Computer Hardware Engineering	7.5	First cycle

## Year 3

### Track, Networked Control Systems (NCSS)

#### Year 1

##### Mandatory courses (7.5 credits)

Course code	Course name	Credits	Edu. level
EL2450	Hybrid and Embedded Control Systems	7.5	Second cycle

##### Conditionally elective courses

Course code	Course name	Credits	Edu. level
DD2421	Machine Learning	7.5	Second cycle
DD2424	Deep Learning in Data Science	7.5	Second cycle
EL2320	Applied Estimation	7.5	Second cycle
EL2425	Automatic Control, Project Course, Smaller Course	7.5	Second cycle
EL2620	Nonlinear Control	7.5	Second cycle
EL2700	Model Predictive Control	7.5	Second cycle
EL2805	Reinforcement Learning	7.5	Second cycle

Course code	Course name	Credits	Edu. level
EP2200	Queuing Theory and Teletraffic Systems	7.5	Second cycle
EP2500	Networked Systems Security	7.5	Second cycle
MF2007	Dynamics and Motion Control	9.0	Second cycle
MF2043	Robust Mechatronics	6.0	Second cycle

## Year 2

### Mandatory courses (7.5 credits)

Course code	Course name	Credits	Edu. level
EP2700	Principles of Wireless Sensor Networks	7.5	Second cycle

### Conditionally elective courses

Course code	Course name	Credits	Edu. level
DD2421	Machine Learning	7.5	Second cycle
EL2320	Applied Estimation	7.5	Second cycle
EL2425	Automatic Control, Project Course, Smaller Course	7.5	Second cycle
EL2620	Nonlinear Control	7.5	Second cycle
EL2700	Model Predictive Control	7.5	Second cycle
EL2805	Reinforcement Learning	7.5	Second cycle
EP2200	Queuing Theory and Teletraffic Systems	7.5	Second cycle
EP2500	Networked Systems Security	7.5	Second cycle
MF2007	Dynamics and Motion Control	9.0	Second cycle
MF2043	Robust Mechatronics	6.0	Second cycle
SF2852	Optimal Control Theory	7.5	Second cycle

## Year 3

### Track, Robotics and Autonomous Systems (RASM)

## Year 1

### Mandatory courses (15.0 credits)

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Course code	Course name	Credits	Edu. level
DD2423	Image Analysis and Computer Vision	7.5	Second cycle
EL2320	Applied Estimation	7.5	Second cycle

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### Conditionally elective courses

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Course code	Course name	Credits	Edu. level
DD2380	Artificial Intelligence	6.0	Second cycle
DD2411	Research project in Robotics, Perception and Learning	15.0	Second cycle
DD2419	Project Course in Robotics and Autonomous Systems	9.0	Second cycle
DD2421	Machine Learning	7.5	Second cycle
DD2424	Deep Learning in Data Science	7.5	Second cycle
DD2425	Robotics and Autonomous Systems	9.0	Second cycle
DD2429	Computational Photography	6.0	Second cycle
DD2434	Machine Learning, Advanced Course	7.5	Second cycle
DD2437	Artificial Neural Networks and Deep Architectures	7.5	Second cycle
EL2425	Automatic Control, Project Course, Smaller Course	7.5	Second cycle
EL2450	Hybrid and Embedded Control Systems	7.5	Second cycle
EL2620	Nonlinear Control	7.5	Second cycle
EL2700	Model Predictive Control	7.5	Second cycle
EL2805	Reinforcement Learning	7.5	Second cycle
EQ2300	Digital Signal Processing	7.5	Second cycle
EQ2321	Speech and Audio Processing	7.5	Second cycle
MF2007	Dynamics and Motion Control	9.0	Second cycle

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## Year 2

### Conditionally elective courses

Course code	Course name	Credits	Edu. level
DD2380	Artificial Intelligence	6.0	Second cycle
DD2411	Research project in Robotics, Perception and Learning	15.0	Second cycle
DD2419	Project Course in Robotics and Autonomous Systems	9.0	Second cycle
DD2421	Machine Learning	7.5	Second cycle
DD2425	Robotics and Autonomous Systems	9.0	Second cycle
DD2429	Computational Photography	6.0	Second cycle
DD2434	Machine Learning, Advanced Course	7.5	Second cycle
DD2437	Artificial Neural Networks and Deep Architectures	7.5	Second cycle
EL2425	Automatic Control, Project Course, Smaller Course	7.5	Second cycle
EL2450	Hybrid and Embedded Control Systems	7.5	Second cycle
EL2620	Nonlinear Control	7.5	Second cycle
EL2700	Model Predictive Control	7.5	Second cycle
EL2805	Reinforcement Learning	7.5	Second cycle
EQ2300	Digital Signal Processing	7.5	Second cycle
EQ2321	Speech and Audio Processing	7.5	Second cycle
MF2007	Dynamics and Motion Control	9.0	Second cycle

## Year 3

### Track, Systems and Control Theory (SCTY)

#### Year 1

#### Mandatory courses (15.0 credits)

Course code	Course name	Credits	Edu. level
EL2620	Nonlinear Control	7.5	Second cycle
EL2700	Model Predictive Control	7.5	Second cycle

#### Conditionally elective courses

Course code	Course name	Credits	Edu. level
EL2425	Automatic Control, Project Course, Smaller Course	7.5	Second cycle

<b>Course code</b>	<b>Course name</b>	<b>Credits</b>	<b>Edu. level</b>
EL2450	Hybrid and Embedded Control Systems	7.5	Second cycle
EL2805	Reinforcement Learning	7.5	Second cycle
EQ2300	Digital Signal Processing	7.5	Second cycle
EQ2401	Adaptive Signal Processing	7.5	Second cycle
SF1691	Complex Analysis <i>Replaces SF1628</i>	7.5	First cycle
SF2832	Mathematical Systems Theory	7.5	Second cycle
SF2842	Geometric Control Theory	7.5	Second cycle

## Year 2

### Conditionally elective courses

<b>Course code</b>	<b>Course name</b>	<b>Credits</b>	<b>Edu. level</b>
EL2425	Automatic Control, Project Course, Smaller Course	7.5	Second cycle
EL2450	Hybrid and Embedded Control Systems	7.5	Second cycle
EL2620	Nonlinear Control	7.5	Second cycle
EL2700	Model Predictive Control	7.5	Second cycle
EL2805	Reinforcement Learning	7.5	Second cycle
EQ2300	Digital Signal Processing	7.5	Second cycle
EQ2401	Adaptive Signal Processing	7.5	Second cycle
EQ2810	Estimation Theory, Accelerated Program Course	6.0	Second cycle
EQ2820	Matrix Algebra, Accelerated Program	7.5	Second cycle
SF1691	Complex Analysis <i>Replaces SF1628</i>	7.5	First cycle
SF2832	Mathematical Systems Theory	7.5	Second cycle
SF2842	Geometric Control Theory	7.5	Second cycle
SF2852	Optimal Control Theory	7.5	Second cycle

## Year 3



## Appendix 2: Specialisations

Master's Programme, Systems, Control and Robotics, 120 credits (TSCRM), Programme syllabus for studies starting in autumn 2018

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### Track, Electrical Energy Systems (ELEM)

#### Requirements for track Electrical Energy Systems (ES)

- Compulsory courses year 1: EG2100, EL2450
- Conditionally elective (at least 3 of): EL2421, EL2425, EL2620, EL2700, EJ2301, EG2110, EJ2201, IS1200, EK2350, EK2360, EH2741, EH2745

### Track, Networked Control Systems (NCSS)

#### Requirements for track Networked Control Systems (NC)

- Compulsory courses year 1: EL2450
- Compulsory courses year 2: EP2700
- Conditionally elective (at least 3 of): EP2200, EL2320, EL2425, EL2620, EL2700, EL2805, EP2500, MF2043, MF2007, DD2421, SF2852

### Track, Robotics and Autonomous Systems (RASM)

#### Requirements for track Robotics and Autonomous System (RA)

- Compulsory courses year 1: EL2320, DD2423
- Conditionally elective (at least 3 of): DD2380, DD2411, DD2419, DD2421, DD2425, DD2429, DD2434, DD2437, EL2425, EL2450, EL2620, EL2700, EL2805, EQ2321, EQ2300, MF2007

### Track, Systems and Control Theory (SCTY)

#### Requirements for track Systems and Control Theory (SC)

- Compulsory courses year 1: EL2620, EL2700
- Conditionally elective (at least 3 of): SF1691, SF2832, SF2842, SF2852, EL2425, EL2450, EL2805, EQ2300, EQ2401, EQ2800, EQ2810, EQ2820