Chapter 9
The programme specific part of the curriculum for:

CIVILINGENIØR (CAND.POLYT) I ROBOTTEKNOLOGI
Master of Science in Robot Systems Engineering

Study start: September 2009, Version 1.0

Please note that this version is a translation from Danish. In the event of discrepancies or ambiguity between this translation and the Danish version, the Danish version shall prevail.

The curriculum is divided into general provisions (Chapters 1-8), a programme specific part (Chapter 9) and the module descriptions for the subjects studied for each programme. Students should familiarise themselves with all three parts in order to acquire a full overview of the rules that apply throughout the study programme.

1 Job profiles

Robots are the future. Robots embody creativity and advanced technology.

Robots of all types and of all sizes are gaining a foothold in society. From enormous fixed installations on the factory floor to small mobile surgical devices. The master programme in Robot Systems Engineering is for students who want to work with the technology of the future.

The development of robotic technology requires engineers who can work creatively across the industry's academic fields and within research.

The master programme in Robot Systems Engineering provides a wide research-based study programme in robot-related areas such as: computer vision, applied mathematics, artificial intelligence, software development and embedded systems. The broad composition of academic fields provides students with competencies and expertise enabling them to create the robots of the future for production and service applications.

By specialising in one of the study programme's profiles, students are given the opportunity to work together with researchers at the highest international level.

The MSc (Eng) in Robot Systems Engineering leads to general data technological skills which, as well as qualifying students to work in the robot industry, also qualify them for other high-tech fields using built-in electronics and software. For example: mobile phones, web applications, machine construction, security systems, large software applications and lots more.

2 The competency profile of the study programme

The student can

- Apply the scientific methods and tools of robotics, as well as using general skills related to employment within the academic field;
- Assess and select appropriate scientific theories, methods, tools and general skills from robotics, as well as setting up new analysis and solution models on a scientific basis;
- Communicate research-based knowledge and discuss professional and scientific problems with both fellow professionals and non-specialists;
- Control work and development situations that are complex, unpredictable and assume new solution models;
- Independently initiate and implement professional and interdisciplinary collaboration and take on professional responsibility;
- Independently take responsibility for their own professional development and specialisation;
- Demonstrate a wide knowledge of robotics and data technology; and
- Demonstrate research-based knowledge of all the study programme's profiles; and
- Demonstrate knowledge of one or more of the study programme's profiles, based on the highest level of international research.
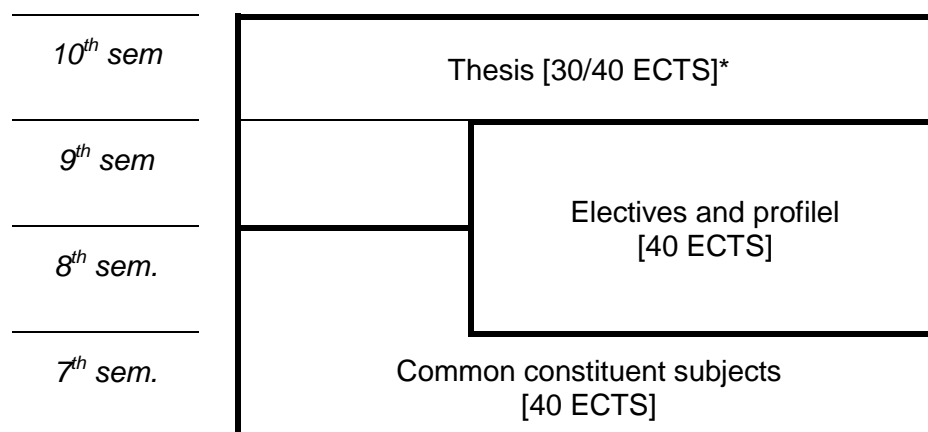
3 The subject columns of the study programme

The study programme contains six subject columns, five of which overlap with the programme's five academic profiles (see section 4 below):

- **Scientific Methods and Tools of Robotics**

- **Robotics**

- **Artificial Intelligence**

- **Software System Engineering**

- **Embedded Systems**

- **Computer Vision**

4 The academic profiles of the study programme

The study programme consists of three elements:

- The common constituent subjects which are mandatory for all students and shall provide the students with a common skills platform that broadly covers the field of robotics;
- Elective and profile subjects which shall define the academic profile of the individual student and prepare them to write a thesis within a given field; and
- The Master's Thesis which shall showcase each student's skills in a specialised in-depth study of a robotics topic.

10th sem	Thesis [30/40 ECTS]*
9th sem	
	Electives and profilel [40 ECTS]
8th sem.	
7th sem.	Common constituent subjects [40 ECTS]

*If the thesis is of an experimental nature, the student may decide to use the optional 10 ECTS points in the ninth semester as part of this thesis. This extends the thesis to 40 ECTS points.

The following five subject profiles are offered:

Robotics
- Kinematics
- Robotics and automation
- Mathematic modelling of industrial systems
- Computer simulation and animation

Artificial Intelligence
- Classical artificial intelligence
- 'Behaviour-based' artificial intelligence
- Neural networks
- Generic algorithms
- Adaptive robots
- Bio-inspired robots

Software System Engineering
- Object-oriented system development
- Software architecture
- Agent-oriented programming
- Software development for pervasive and ubiquitous computing systems

Embedded Systems
- Programmable electronics
- Hardware/software co-design
- Hardware-near programming
- Data communication

Computer Vision
- Image processing
- Object recognition
- Real-time tracking of dynamic objects
- 3D Kalman filtering
- Vision in robot setups

Students acquire research-based skills within all five profiles.
They also acquire skills based on the highest level of international research within at least one of the five profiles.

5 The structure and modules of the study programme

Semester		STRUCTURE		
10		**Thesis**		
9		**Elective/Thesis***	**Elective**	**Profile subject**
8		**RMRSD1**	**Elective**	**Profile subject**
7.	2nd quarter	**RMEMB1**	**RMVIS1**	**RMROB1**
	1st quarter	**RMSCM1**	**RMAI1**	**RMSSE1**
ECTS POINT		1 2 3 4 5 6 7 8 9 10	11 12 13 14 15 16 17 18 19 20	21 22 23 24 25 26 27 28 29 30

*If the thesis is of an experimental nature, the student may decide to use the optional 10 ECTS points in the ninth semester as part of this thesis. This extends the thesis to 40 ECTS points.

6 Description of the common compulsory subjects

The common constituent subjects take the students on a tour of the robotics profiles and introduce them to the scientific methods of the field.

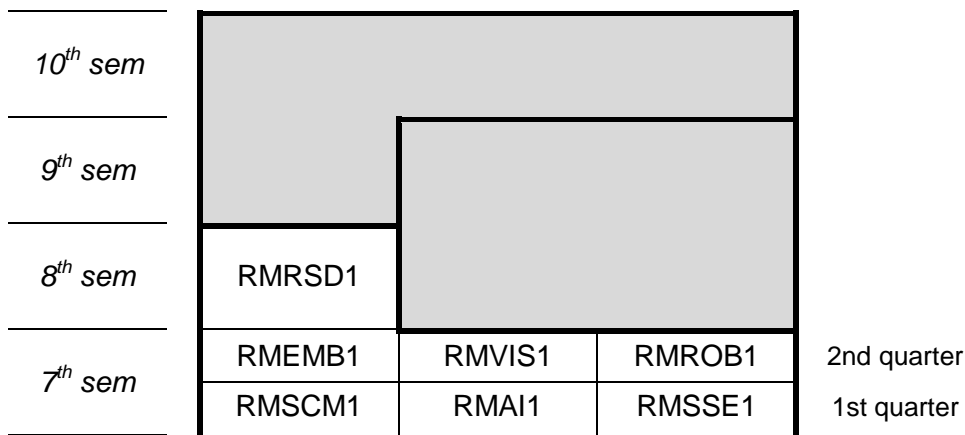The seventh semester is divided into two quarters.
In the first quarter there is teaching in Artificial Intelligence (RMAI1), Software System Engineering (RMSSE1) and Scientific Method (RMSCM1).
Students without skills in system development or programming must complete an introductory course in Software System Engineering (RMSSE0) rather than the mandatory course (RMSSE1) in the seventh semester. The students in question may then complete the mandatory course (RMSSE1) in their ninth semester, and they should not expect to be able to follow the Software System Engineering profile.

In the second quarter there is teaching in Embedded Systems (RMEMB1), Computer Vision (RMVIS1) and Robot Kinematics (RMROB1).

The subjects in each quarter can be arranged so they are more or less cohesive.

All the academic skills from the seventh semester are bound together in the eighth semester, in which robotics is approached from a holistic perspective at system level.

10th sem				
9th sem				
8th sem	RMRSD1			
7th sem	RMEMB1	RMVIS1	RMROB1	2nd quarter
	RMSCM1	RMAI1	RMSSE1	1st quarter

7 Module descriptions

A detailed description of the common constituent subjects can be found in the module descriptions for the MSc (Eng) in Robot Systems Engineering. The module descriptions are found in the Course Database for the Faculty of Engineering on the Faculty's website.
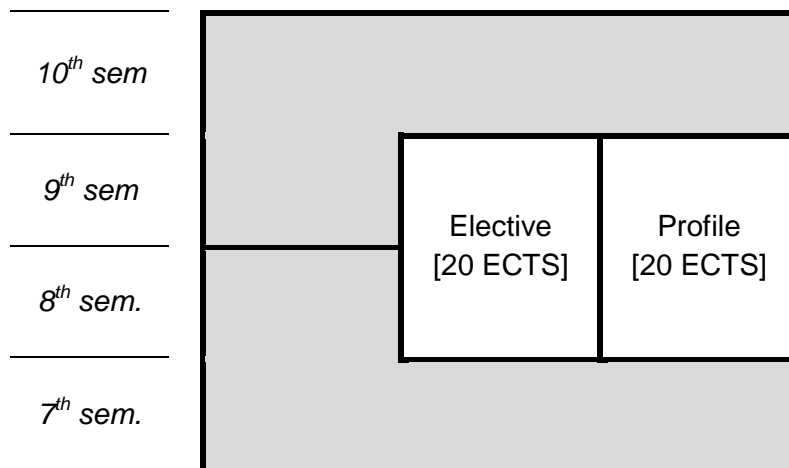
8 Descriptions of electives and profiles

The elective and profile courses are in the eighth and ninth semesters of the study programme.

To qualify to write a thesis within a given profile, students must have passed at least 20 ECTS points in 'semi-mandatory' courses within the relevant profile.

In the optional pool, students can decide to take additional courses within their own profile, courses from the other profiles, generally offered elective courses or relevant courses from other study programmes, institutes/departments, faculties or universities.

The elective and profile courses are very dynamic and they are based on the Institute's current research. This means that the content of the courses is likely to change fairly often. The current offering of elective and profile courses will be published in a course catalogue one month into the preceding semester, i.e. spring courses are announced on 1 October and autumn courses are announced on 1 March.

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10th *sem*	
9th *sem*	Elective [20 ECTS] / Profile [20 ECTS]
8th *sem.*	
7th *sem.*	

9 Module descriptions

A detailed description of the study programme's elective and profile subjects can be found in the module descriptions for the MSc (Eng) in Robot Systems Engineering. The module descriptions are found in the Course Database for the Faculty of Engineering on the Faculty's website.

10 Description of the Master's Thesis

The thesis element is worth 30 ECTS points. If the thesis is of an experimental nature, the student may decide to use the optional 10 ECTS points as part of this thesis. This extends the thesis to 40 ECTS points and its duration to two semesters.

Theses are generally carried out in groups of two people.

10th sem	Thesis [30/40 ECTS]
9th sem	
8th sem.	
7th sem.	
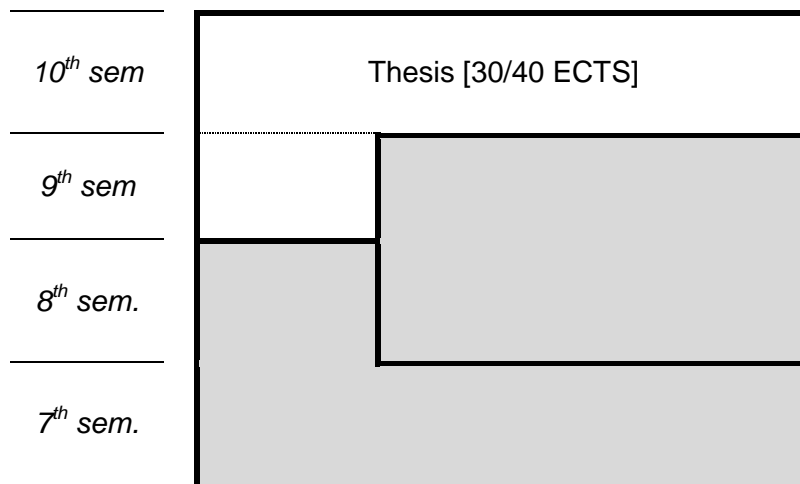
11 Module descriptions

A module description for the thesis for the MSc (Eng) in Robot Systems Engineering and electives offered can be found in the Course Database for the Faculty of Engineering on the Faculty's website.

12 Admission to the study programme

1. Bachelors with automatic right of admission

Bachelors of Science in Robot Systems Engineering:
Graduates with a BSc (Eng) degree in Robot Systems Engineering from the Faculty of Engineering, University of Southern Denmark are automatically entitled to admission to the MSc (Eng) programme in Robot Systems Engineering.

2. Other qualifying bachelor degrees (from University of Southern Denmark)

Bachelors of Engineering in Information and Communication Technology
Graduates with a Bachelor of Engineering degree in Information and Communication Technology from the Faculty of Engineering, University of Southern Denmark are automatically entitled to admission to the academic profile 'Software System Engineering'.

Bachelors of Engineering in Electrotechnics (Computer Engineering)
Graduates with a Bachelor of Engineering degree in Electrotechnics (Computer Engineering) from the Faculty of Engineering, University of Southern Denmark are automatically entitled to admission to the MSc (Eng) programme in Robot Systems Engineering.

Bachelors of Engineering in Electrotechnics (Electronic Engineering)
Graduates with a Bachelor of Engineering degree in Electrotechnics (Electronic Engineering) from the Faculty of Engineering, University of Southern Denmark are automatically entitled to admission to academic profile 'Embedded Systems' provided that they have passed the elective courses 'Software Development' and 'Numerical Analysis'.

Bachelors of Science in Computer Science with the subsidiary subject 'Industrial Software Production'
Graduates with a BSc (Eng) degree in Computer Science with the subsidiary subject 'Industrial Software Production' from The Faculty of Science, University of Southern Denmark are automatically entitled to admission to the academic profile 'Software System Engineering'.

3. Other qualifying degrees

Bachelors of Science in Engineering and Bachelors of Engineering from other universities
Graduates with a BSc (Eng) or a BEng degree from other Danish and international universities as well as other applicants from related study programmes can be admitted to the study programme subject to an individual assessment. The assessment will consider whether the academic qualifications of the applicant correspond to those of the abovementioned BSc (Eng) or BEng degrees from the Faculty of Engineering, University of Southern Denmark.

13 External examiners and Academic Study Board

The study programme falls under the Academic Study Board of the Faculty of Engineering and the Danish body of external examiners for engineering education.

14 Entry into force

Approved on 23 June 2009 by the Academic Study Board of the Faculty of Engineering.

Approved on 23 June 2009 by the Director of Studies on behalf of the Dean of the Faculty of Engineering.