Master's Programme (120 credits) in Embedded and Intelligent Systems, 120 credits

Masterprogram i inbyggda och intelligenta system, 120 hp

The Study programme is adopted by the Research and Education Board (2019-10-10) and is valid for students admitted for the autumn semester 2020.

Degree Programme Objectives

The primary objective of the study programme is that the student shall develop theoretical and practical competence for research, development and practical construction of embedded and intelligent systems within the main field of computer science and engineering.

The study programme also has the objective that the student shall gain deepened knowledge within some of the following more specific subject areas: computer architecture, communication systems, real-time computer systems, signal analysis, sensor systems, learning systems, data mining and control theory. By the choice of courses the student has the option to focus on the either embedded systems or intelligent systems.

The student shall with the programme reach a sufficient basis for PhD studies or advanced project work within industry.

Upon completion of the programme the student shall be able to:

Knowledge and understanding

- describe how embedded and intelligent systems are constructed and organized
- describe the methods that are applied when developing the systems and for their importance and use in the field of technology
- discuss the level of the international research and its contemporary development within the area of the chosen specialization

Skills and abilities

- search for solutions to technically complex research tasks, assess scientific papers and use advanced methods of analysis and construction within the chosen specialization
- systematically compare own work to international research in Computer Science and Engineering
- carry out an advanced development task within specified time frames, present and defend his work, orally as well as in writing, in an international research environment

Judgement and approach

- assess and evaluate work of research and development, based on own experience, from technical as well as social and ethical aspects
- make judgements about Computer Science and Engineering with respect to opportunities, limitations, its role in society, as well as the responsibility of computer scientists and engineers for how it is applied
- identify own needs for additional knowledge and independently take responsibility for own knowledge development

Degree Programme Primary Contents and Planning

In the first semester basic courses within the main area of the programme are taken. If the student has knowledge corresponding to the course "Algorithms, Data Structures and Problem Solving" 7,5 credits the course "Real-Time Embedded System" 7,5 credits can be chosen already year 1 instead of year 2.

In the second semester all students take courses that increase depth of knowledge in regard to intelligent and autonomous vehicles (including relevant sensor techniques), machine learning and image analysis.

In the third semester all students take the project course Design of embedded intelligent systems in which the student takes part in a larger project. In addition an optional course is taken, and the thesis project is started with a prestudy.

In the fourth semester the thesis is done and an elective course is chosen to gain further deepened knowledge.

Instruction is generally in the form of lectures, seminars, laboratory work, consultation and project work. Several courses have compulsory assignments that shall be presented both in writing and orally.
Teaching language is English.

The following courses are offered within the programme
(1st - First cycle, 2nd - Second cycle)
Courses marked with asterisk (*) is included in the programme main area Computer Science and Engineering.

Semester 1

Compulsory courses:

Algorithms, Data Structures and Problem Solving, 7.5 credits (1st) *
Artificial Intelligence, 7.5 credits (2nd)*
Networks for Embedded Systems, 7.5 credits (2nd)*
Engineering Mathematics, 7.5 credits (2nd)

Elective course:

Real-time Embedded System, 7.5 credits (2nd)*

Semester 2

Compulsory courses:

Learning Systems, 7.5 credits (2nd)*
Intelligent Vehicles, 7.5 credits (2nd)*
Image Analysis, 7.5 credits (2nd)*

Elective courses:

Robotics, 7.5 credits (2nd)*
Embedded Parallel Computing 7.5 credits (2nd)*

Semester 3

Compulsory courses:

Design of Embedded and Intelligent Systems, 15 credits (2nd)*
Thesis, 30 credits (2nd)*

Elective courses:

Real-Time Embedded Systems 7.5 credits (2nd)*
Testing and Verification of Embedded Systems 7.5 credits (2nd)*
Data Mining 7.5 credits (2nd)*

Semester 4

Compulsory courses:

Thesis, 30 credits (2nd)*

Elective courses:

Computer Vision in 3D, 7.5 credits (2nd)*
Dependable and Real-time Data Communication 7.5 credits (2nd)*

Elective courses are primarily chosen within the programme. The student has the option to choose an elective (7.5 credits) outside the programme in semester 3 or 4 within the areas of engineering, mathematics, innovation and entrepreneurship.

Of the courses in the degree at least 112.5 credits have to be on second cycle. First cycle courses may be included only in the case when such a course is needed for the student to be able to take another course in the programme.

The university reserves the right to cancel courses chosen by less than 12 students.

Prerequisites and Conditions of Admission

Bachelor of Science degree (equivalent of 180 Swedish credit points / ECTS credits at an accredited university) in an engineering subject or in computer science.

Courses in computer science, computer engineering or electrical engineering of at least 90 higher education credits, including thesis.

Courses in mathematics of at least 30 higher education credits or courses including calculus, linear algebra and transform methods.

Applicants must have written and verbal command of the English language equivalent to English course 6 in Swedish Upper-Secondary School.

Degree Title

The degree is 120 credits. For obtaining the degree is required that the prerequisites of the programme are fulfilled and in addition to this that at least 120 credits have been obtained following the directions above.

Upon completion of the degree programme, a degree certificate will be issued bearing the degree programme title in Swedish: Teknologiemasterexamen med huvudområdet datateknik. In English: Master of Science (120 credits) with a major in Computer Science and Engineering. In the degree certificate is also stated the specialisation of the education: Embedded and Intelligent Systems.

Quality assurance and student participation

The programme is monitored and evaluated on a regular basis through the course evaluations that are carried out after each completed course. Course evaluations are a tool for making changes in the content and implementation of the program-
me based on the students’ opinions and experiences. After completing the education, all students are offered the opportunity to participate in a programme evaluation. The result of this participation can lead to changes in the programme. A programme advisory team is attached to the programme who, in turn, address quality and development issues. The programme advisory team consists of representatives from e.g. the business sector, programme students, and alumni. Students are represented in the university’s decision-making team, who, among other things, make decisions concerning educational plans and course syllabi. The students are also part of the committees that evaluate programmes in accordance with the university’s quality system.

**Requirements for Progression to Higher Levels within the Degree Programme**

Promotion requirements apply in order to participate in the next level of the programme. From study year 1 to study year 2 a total of at least 40 credits from study year 1 must be completed.

A check is done after the examination period in June and a follow-up after the examination period in August.

**Appendices**

In addition to the syllabus there is also Appendix 1 which shows the sequential order of the programme’s sub-component courses. In cases where the programme leads to the award of a degree, there is also Appendix 2 which states which courses fulfill nationally-established degree objectives.

These appendices can be obtained from the School of Information Technology.