Electronics Engineering, Master's Programme

120 credits

Electronics Engineering, masterprogram

6MELE

Valid from: 2017 Spring semester

Determined by
Faculty Board of Institute of Technology

Date determined
2017-01-25

Purpose

The objective of this master's programme is to provide a strong and competitive education in Electronics Engineering, with emphasis on design of integrated circuits and System-on-Chip in advanced semiconductor technologies as well as embedded systems. The motivation behind the programme is the growing global demand for electronics engineers with knowledge and skills in design of digital, analogue, and Radio Frequency (RF) integrated circuits and System-on-Chip (SoC), combined with in-depth knowledge in signal processing, application specific processors, embedded systems design, modern communications systems, and radio transceivers design. Mobile phones, internet, PCs and TVs, are just a few examples that constantly improve in functionality, performance and cost. In addition, there is growing number of concepts and technologies which will significantly improve areas such as mobile and broadband communications, healthcare, automotive, robotics, energy-systems management, entertainment, consumer electronics, public safety and security, industrial applications, and much more. This indicates that there will be large industrial opportunities in the future, and also large demand for competent engineers with the required knowledge and skills to lead the design of such complex integrated circuits and systems.

Aim

Knowledge and reasoning in mathematics, natural sciences, and engineering

Graduates from the Master's programme in Electronics Engineering should

- have a solid knowledge in design of integrated circuits and System-on-Chip (SoC), as well as in-depth understanding of signal processing, application specific processors, embedded systems design, and modern communications systems.
- understand, formulate, and solve the complex problems related to the design of integrated circuits and system-on-chip.
- be able to apply modern methodologies for design of integrated circuits and systems.
- be able to carry out modelling, simulation, and physical design of RF, analogue, and digital integrated circuits and systems in advanced semiconductor technologies
- be able to make effective use of computers and Computer-Aided Design (CAD) tool environments
- be able to carry out measurement and evaluation of integrated circuits and systems.

Personal and professional skills and attributes

Graduates from the Master's programme in Electronics Engineering should

- be able to formulate a model for a relevant problem and critically evaluate its validity.
- be creative, enterprising and take responsibility for the own contribution to the solution of a problem.

Interpersonal skills: teamwork and communication

Graduates from the Master's programme in Electronics Engineering should

- be capable of teamwork and active collaboration within a group by sharing tasks and responsibilities
- be able to initialize, plan, carry out and evaluate scientific and engineering projects
- be able to communicate and to give presentations in English, orally and in writing

Conceiving, designing, implementing, and operating systems in the enterprise and social context

Graduates from the Master's programme in Electronics Engineering should

- have a deep insight into the broad field of science and engineering: from initial concepts to implementation aspects
- be aware of the impact of science and engineering on society

Content

The programme includes two years of studies, and it contains both compulsory and elective courses.

The first semester consists of a set of compulsory courses providing the necessary knowledge in digital and analog integrated circuits, telecommunications, RF electronics and design of digital systems.

Education profiles

During the second and third semester it is compulsory for the student to follow one of the two specializations (tracks) in the programs, and they are:

- System on Chip with focus on digital system on chip design and embedded systems
- Analogue/Digital and RF IC Design with emphasis on design of mixed Analogue/Digital and radio frequency integrated circuits

A specialization consists of a set of compulsory courses, and the compulsory courses for each specialization are given by the Curriculum. For the System on Chip specialization the compulsory courses are:

- System Design and Methodology
- VLSI Design
- Design of Embedded DSP Processor
- Evaluation of an Integrated Circuit
- Communication, Ethics and Sustainable Development

and for the Analogue/Digital and RF IC Design specialization the compulsory courses are:

- Radio Frequency Integrated Circuits
- VLSI Design
- Evaluation of an Integrated Circuit
- Radio Frequency Transceiver Design
- Communication, Ethics and Sustainable Development

In addition to the compulsory courses during the second and third semester the program offers a large number of complementary and highly related elective courses offered within both Electrical Engineering and Computer Science, which can be selected by students depending on the individual directions of interests.

Finally, the fourth semester is dedicated to the Master's thesis project.

Entry requirements

- Bachelor's degree in electrical engineering or equivalent
- 20 ECTS credits in mathematics/applied mathematics and/or applications of mathematics relevant for the programme, including courses in calculus, linear algebra, probability, transform methods
- English corresponding to the level of English in Swedish upper secondary education (English 6/B)

Degree thesis

The thesis should be based on the high quality scientific content and carried out in close contact with the research groups involved in the programme and in the area of the profile chosen by the students. Without special permission a thesis work may be performed in the following subject areas:

- Electronic Devices
- Electronic Systems
- Communication Systems
- Computer Engineering

Degree requirements

The programme is designed to give the Master's Degree "Teknologie masterexamen i elektroteknik" translated to "Master of Science (2 years) with a major Electrical Engineering".

The requirements are the following:

- a Bachelor's degree as specified in the entrance requirements
- course requirements for a total of 120 ECTS credits from courses from the curriculum of the programme, or after special decision from the programme board, and thesis work.
- passed the requirements for all compulsory courses
- courses on advancement level A (advanced) 90 ECTS credits including:
    - at least 30 ECTS credits courses from the major subject, Electrical Engineering
    - a 30 ECTS credits Master's Thesis in the major subject, Electrical Engineering
- at least 45 ECTS credits from courses in mathematics or applications of mathematics from the Bachelor level (basic) or Master level (advanced), see list of specific courses
- a Master's thesis presented and passed according to the regulations at the Faculty of Science and Engineering.

Courses overlapping each other regarding contents are not allowed to be included in the degree. Courses used for the Bachelor's degree can never be included in the Master's degree.

Degree in Swedish

Master of Science (120 credits) with a major in Electrical Engineering

Degree in English

Master of Science (two years) with a major in Electrical Engineering

Specific information

Certain PhD courses can be taken by master students. Please contact the directors of graduate studies:

- Deptartment of Electrical Engineering, forskarstudierektor@isy.liu.se
- Deptartment of Computer and Information Science, forskarstudierektor@ida.liu.se

Common rules

See also common rules

Curriculum

Semester 1 (Autumn 2017)

Course code	Course name	Credits	Level	Timetable module	ECV
Period 1					
TSKS01	Digital Communication	6*	A1X	4	C
TSTE12	Design of Digital Systems	6	A1X	3	C
TSTE86	Digital Integrated Circuits	6	A1X	2	C
Period 2					
TSEK02	Radio Electronics	6	A1X	3	C
TSEK37	Analog CMOS Integrated Circuits	6	A1X	1	C
TSKS01	Digital Communication	6*	A1X	4	C

Semester 2 (Spring 2018)

Specialisation: Analogue/Digital and RF IC Design

Course code	Course name	Credits	Level	Timetable module	ECV
Period 1					
THEN24	Communication, Ethics and Sustainable Development	6*	G1X	-	C
TSEK06	VLSI Design	12*	A1X	4	C
TSEK38	Radio Frequency Transceiver Design	6	A1X	2	C
TDTS07	System Design and Methodology	6	A1X	1	E
TSKS13	Wireless Communications	6	A1F	4	E
TSTE08	Analog and Discrete-Time Integrated Circuits	6	A1X	3	E
TSTE14	Analog Filters	6	A1X	2	E
Period 2					
THEN24	Communication, Ethics and Sustainable Development	6*	G1X	-	C
TSEK06	VLSI Design	12*	A1X	4	C
TSKS14	Multiple Antenna Communications	6	A1X	2	E
TSTE06	Digital Filters	6	A1X	3	E
TSTE87	Application-Specific Integrated Circuits	6	A1X	2	E

Specialisation: System-on-Chip

Course code	Course name	Credits	Level	Timetable module	ECV
Period 1					
TDTS07	System Design and Methodology	6	A1X	1	C
THEN24	Communication, Ethics and Sustainable Development	6*	G1X	-	C
TSEK06	VLSI Design	12*	A1X	4	C
TDDD25	Distributed Systems	6	A1X	2	E
TSTE08	Analog and Discrete-Time Integrated Circuits	6	A1X	3	E
Period 2					
THEN24	Communication, Ethics and Sustainable Development	6*	G1X	-	C
TSEK06	VLSI Design	12*	A1X	4	C
TDDC78	Programming of Parallel Computers - Methods and Tools	6	A1X	3	E
TSKS14	Multiple Antenna Communications	6	A1X	2	E
TSTE06	Digital Filters	6	A1X	3	E
TSTE87	Application-Specific Integrated Circuits	6	A1X	2	E

Semester 3 (Autumn 2018)

Specialisation: Analogue/Digital and RF IC Design

Course code	Course name	Credits	Level	Timetable module	ECV
Period 1					
TSEK03	Radio Frequency Integrated Circuits	6	A1X	2	C
TSEK11	Evaluation of an Integrated Circuit	2	A1X	4	C
TNE071	Microwave Engineering	6	A1X	1	E
TSEA26	Design of Embedded DSP Processor	6	A1X	1	E
TSEA84	Digital Design Project	6*	A1X	3	E
TSTE25	Power Electronics	6	A1X	3	E
Period 2					
TFYA39	Semiconductor Technology	6	A1X	3	E
TNE083	Antenna Theory	6	A1X	2	E
TSEA84	Digital Design Project	6*	A1X	3	E
TSTE26	Powergrid and Technology for Renewable Production	6	A1X	3	E
TSTE85	Low Power Electronics	6	A1X	2	E

Specialisation: System-on-Chip

Course code	Course name	Credits	Level	Timetable module	ECV
Period 1					
TSEA26	Design of Embedded DSP Processor	6	A1X	1	C
TSEK11	Evaluation of an Integrated Circuit	2	A1X	4	C
TDTS08	Advanced Computer Architecture	6	A1X	2	E
TSEA84	Digital Design Project	6*	A1X	3	E
TSEK03	Radio Frequency Integrated Circuits	6	A1X	2	E
TSTE17	System Design	12*	A1F	4	E
TSTE25	Power Electronics	6	A1X	3	E
Period 2					
TDDD07	Real Time Systems	6	A1X	4	E
TDDD56	Multicore and GPU Programming	6	A1X	2	E
TFYA39	Semiconductor Technology	6	A1X	3	E
TSEA44	Computer Hardware - a System on Chip	6	A1F	1	E
TSEA84	Digital Design Project	6*	A1X	3	E
TSTE17	System Design	12*	A1F	4	E
TSTE26	Powergrid and Technology for Renewable Production	6	A1X	3	E
TSTE85	Low Power Electronics	6	A1X	2	E

Semester 4 (Spring 2019)

Course code	Course name	Credits	Level	Timetable module	ECV
Period 1					
TQXX30	Degree project - Master's Thesis	30*	A1X	-	C
Period 2					
TQXX30	Degree project - Master's Thesis	30*	A1X	-	C

ECV = Elective / Compulsory /Voluntary
*The course is divided into several semesters and/or periods