

Micro- and Nanoelectronic Circuit Design 2018-2019 & 2019-2020

Code: ELEC3036

Credits: 65 ECTS

Responsible Professors: Jussi Ryyänen and Kari Halonen

Pääaine suomeksi: Mikro- ja nanoelektroniikkasuunnittelu

Huvudämne på svenska: Mikro- och nanoelektronikdesign

Integrated circuits are the enablers of the complex functionality embedded in all present day electronic devices. Combining logic, processors, memory, analog and digital signal processing and radio frequency communications electronics have provided miniaturised implementations of functions that decades ago could not be even dreamed of. In future, it is envisioned that number of integrated circuits per person will continue to increase rapidly simply because the emerging ubiquitous intelligence in all areas of life can not be implemented without them. There is no application that could run without electronic hardware platform.

To be able to design integrated circuits for in embedded devices, the designers needs to handle not only the the theory of electronics, but also the design flow principles, tools, and understand the various abstraction layers of the design presentations. For example, designing he analog front-end amplifier that directly connects to brain sensor, or the RF front-end connecting to antenna, requires understanding of transistor and transmission line models for analog custom circuit and layout design. On the other hand, implementing digital digital circuits, such as processors, DSP accelerators and high speed digital interconnects necessitate the knowledge on hardware efficient implementation methods of signal processing algorithms and good coding practices for hardware description languages, added with capability of efficient and highly automated usage of implementation and verification tool chains.

After completing the major the student knows the most common technologies used in the integrated circuit design. He understand the operation and theory of common circuits used in the circuit design. He knows the design tools used in the design flow and can utilize the functionalities of these programs. He understand the analog, RF and digital circuits. The optional courses in the major will complement student knowledge in the chosen field. The student is able to design integrated circuit blocks from specifications to producible layout.

Courses

| Code | Course | ECTS | Teaching period | Year* |
|--|--|------|-----------------|-------|
| Compulsory courses, common for the Programme; 25 ECTS | | | | |
| ELEC-E0110 | Academic Skills in Master's Studies | 3 | I-V | 1 |
| ELEC-E0210 | Master's Thesis Process | 2 | I-II, III-V | 2 |
| ELEC-E3120 | Analysis and Design of Electronic Circuits | 5 | I-II | 1 |
| ELEC-E3140 | Semiconductor Physics | 5 | I-II | 1 |
| ELEC-E9111 | Mathematical Computing | 5 | I-II | 1 |
| ELEC-E4130 | Electromagnetic fields | 5 | I-II | 1 |
| Compulsory courses for this Major; 30 ECTS | | | | |
| ELEC-E3510 | Basics of IC design | 5 | III | 1 |
| ELEC-E3520 | Digital Microelectronics I | 5 | III | 1 |
| ELEC-E3540 | Digital Microelectronics II | 5 | IV-V | 1 |
| ELEC-E3560 | IC Design Project | 5 | IV-V | 1 |
| ELEC-E3530 | Integrated Analog Systems | 5 | IV-V | 1 |
| ELEC-E3550 | Integrated RF-circuit | 5 | IV-V | 1 |

*Year = The year students are expected to study the course

Optional courses; choose 10 ECTS according to the instructions below

The 10 credits of technical courses can be chosen from any other major in the Master's programmes arranged in School of Electrical Engineering. These can include for example, radio engineering, signal processing, nanotechnology etc. If you want to include courses from other schools this must be agreed with professors in charge of this major.

You will find [recommended study schedules](#) (will be updated in the summer 2018) under Planning your studies.