GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2023-2024

Technology of Integrated Circuits and Microsystems (E031420)

Course size *(nominal values; actual values may depend on programme)*

Credits 6.0 **Study time 180 h**

Course offerings and teaching methods in academic year 2023-2024

A (semester 1)	Dutch	Gent	independent work
B (semester 1)	English	Gent	lecture excursion seminar independent work

Lecturers in academic year 2023-2024

Op de Beeck, Maaike	TW06	lecturer-in-charge
Tzouvadaki, Ioulia	TW06	co-lecturer

Offered in the following programmes in 2023-2024	**crdts**	**offering**
Bridging Programme Master of Science in Electrical Engineering (main subject Electronic Circuits and Systems)	6	B
Master of Science in Electrical Engineering (main subject Electronic Circuits and Systems)	6	B
Master of Science in Electrical Engineering	6	A

Teaching languages

Dutch, English

Keywords

cmos, fabrication, mems, microsystems, technology, PCB

Position of the course

The purpose of this course is to acquaint students with the various technologies for the realization of integrated circuits, printed circuit boards, microfluidic systems and microelectromechanical systems (MEMS). First, the different fabrication technologies are described that serve as the basis for any advanced micro-and nanotechnology (deposition, lithography, etching ...), followed by the realization of different microsystem components (cmos chips, microfluidic components, MEMS and chip packages) and interconnection systems (printed circuit boards, flexible and stretchable electronics). Finally, aspacts regarding sustainability of electronics get attention: environmental aspects, energy consumption,.. during fabrication and usage of electronics, recycling aspects after usage are discussed.

Contents

- Basic technology steps: deposition, lithography, etching, laserstructuring, ...
- Microsystem components: cmos chips, microfluidic components, MEMS and chip packages including system integration on PCB
- Advanced integrated microsystems: microfluidic chips, opto-electronics, flexible & stretchable microsystems, microsystems for medical applications
- Electronic large scale applications, solar cells

- Class regarding sustainability of electronics (fabrication, usage, wast treatment)
- Independent work: virtual clean room visit and demonstrations
- Seminar: practical excercise regarding evaluation of lithographic results on Si-wafers, and corresponding curve fitting excercise
- Excursion: company visit
- Independent work: literature paper study

Initial competences

Basic knowledge physics, chemistry and electronics

Final competences

1 detailed knowledge on microsystems process steps
2 basic knowledge on different types of microsystems
3 insight in the physics of microfabrication
4 knowledge of cleanroom attitude. A virtual cleanroom visit is foreseen: a series of dedicated educational movies showing cleanroom activities will be discussed.
5 analysis of a scientific article
6 writing of a concise scientific report
7 critical evaluation of experimentally obtained data, curve fitting based on predicted theoretical trend, critical interpretation of results.
8 awareness of possibilities and limitations regarding sustainability aspects during fabrication, usage and recycling of electronics.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Excursion, lecture, seminar, independent work

Extra information on the teaching methods

Lectures and independent work: an important part of the classes consists of knowledge clips followed by an interactive Q&A session. After each theoretical topic, some statements about the studied theory are discussed in group.
Independent work: a virtual cleanroom visit is foreseen: a series of dedicated educational movies showing cleanroom activities will be discussed. Students will get questions about the shown demonstrations, to be answered in a report (group activity). Afterwards feedback is provided by a group discussion.
Independent work: literature study (paper analysis)
Excursion: company visit
Seminar: critical evaluation of experimentally obtained data, curve fitting based on predicted theoretical trend, correct interpretation of results.

Learning materials and price

handouts of class room lecture presentations; selected scientific publications for self study and for project. All material will be available for free in electronic version, or student can buy at the VTK the prints of the handouts (~14 Euro (members) and ~17 Euro (non-members))

References

- S. Franssila : "Introduction to Microfabrication", 2nd edition, Wiley, 2010
- M. Madou : "Fundamentals of Microfabrication", 3rd edition, CRC Press, 2011

Course content-related study coaching

Personal contact with 2 professors; interactive support through the electronic learning platform

Evaluation methods

end-of-term and continuous assessment

Examination methods in case of periodic evaluation during the first examination period

Oral assessment open-book

Examination methods in case of periodic evaluation during the second examination period

Oral assessment open-book

Examination methods in case of permanent evaluation

Participation, assignment

Possibilities of retake in case of permanent evaluation

not applicable

Extra information on the examination methods

Periodic evaluation: answering questions based on the handouts of the taught material during the lectures (open book); understanding and explaining a scientific article. Oral exam, open book, no preparation time.

Permanent evaluation:

- report with questions about the cleanroom recordings
- participation: mandatory presence during factory visit and during 1 practical session, mandatory participation (possibly online) in guest lectures and in the thematic lesson 'sustainability of electronics'. In case of absence for any of these activities, each can be replaced by a task, to be arranged with the instructor.

Calculation of the examination mark

The final grade is determined through a combination of periodic evaluation and permanent evaluation:

- Periodic evaluation (oral exam): 90%
- Permanent evaluation (report related to questions about cleanroom recordings): 10%

The score for the mandatory activities (factory visit, practical work, guest lectures, theme sessions) is factored into the oral exam score. Specifically, 5% (1/20) of the achieved exam result is subtracted for each mandatory task/activity that the student did not participate in, and for which no substitute task was completed by the student.