

## 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 2024-2025**

|                |         |      |   |
|----------------|---------|------|---|
| A (semester 1) | Dutch   | Gent | independent work                                    |
| B (semester 1) | English | Gent | excursion<br>seminar<br>independent work<br>lecture |

**Lecturers in academic year 2024-2025**

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

**Offered in the following programmes in 2024-2025**

|   | crdts | offering |
|---|-------|----------|
| <a href="#">Bridging Programme Master of Science in Electrical Engineering(main subject Electronic Circuits and Systems )</a> | 6     | B        |
| <a href="#">Master of Science in Electrical Engineering (main subject Electronic Circuits and Systems)</a>                    | 6     | B        |
| <a href="#">Master of Science in Electrical Engineering</a>   | 6     | A        |

**Teaching languages**

English, Dutch

**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, aspects 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, waste treatment)
- Independent work: virtual clean room visit and demonstrations
- Seminar: practical exercise regarding evaluation of lithographic results on Si-wafers, and corresponding curve fitting exercise
- 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

Seminar, Excursion, Lecture, 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.

### Study material

Type: Handouts

Name: handouts course

Indicative price: € 24

Optional: no

Language : English

### 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

### Assessment moments

end-of-term and continuous assessment

### Examination methods in case of periodic assessment during the first examination period

Oral assessment open-book

### Examination methods in case of periodic assessment during the second examination period

Oral assessment open-book

### Examination methods in case of permanent assessment

Participation, Assignment

### Possibilities of retake in case of permanent assessment

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.