MICRO-303 **Microfabrication I**

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Cursus	Sem.	Type
Microtechnics	BA5	Obl.

Language of teaching	English
Credits	2
Session	Winter
Semester	Fall
Exam	Written
Workload	60h
Weeks	14
Hours	**2 weekly**
Courses	1.5 weekly
Exercises	.5 weekly
Number of positions	

Summary

This course introduces the fundamental process technologies and applications of modern micro- and nanofabrication as practised in cleanroom environments.

Content

The course focuses on conventional silicon-based technologies and also covers topics related to microelectronics, multi-material micro-electromechanical systems, flexible bioelectronic systems, and emerging biomaterial fabrication approaches. In Microfabrication I, students will learn the physical and chemical principles underlying key microfabrication processes, accompanied by comprehensive introductions in the MOOC, and then gain a basic understanding of how individual process steps can be integrated into complete fabrication workflows.
Micro-303 runs in parallel with the Microfabrication practicals (Micro-332), together providing students with a well-rounded understanding and hands-on practice in microfabrication. The course proceeds to the spring course Micro-304, in which advanced process flows for various microsystems will be taught and practised.

Technology content

1. Cleanroom fundamentals
2. Chemical Vapour Deposition (CVD)
3. Physical Vapour Deposition (PVD)
4. Lithography (mask-based and writer, UV and electron-beam)
5. Dry etching
6. Wet etching
7. Inspection and metrology

Application content

1. Microelectronics
2. Microsensors
3. Micro-electromechanical systems
4. Nanoscale systems
5. Microfluidics
6. Flexible electronics
7. Wearable and implantable devices

Keywords

- Cleanroom technology
- Microlithography
- Thin-film processing
- Surface and bulk micromachining
- Integrated microsystems
- Sensors and actuators

Learning Prerequisites

Required courses

Basic knowledge of physics and chemistry is required to understand the principles governing micro- and nanofabrication processes.

Recommended courses

- Physics
- Chemistry
- Electronics

Learning Outcomes

By the end of the course, the student must be able to:

- Identify â#¢ Identify and classify the principal micro- and nanofabrication processes.
- Classify â#¢ Explain the physical and chemical mechanisms underlying fabrication techniques.
- Explain â#¢ Select fabrication approaches according to material compatibility and device requirements.
- Select appropriately â#¢ Design a fabrication process flow for a simple micro- or nanosystem.
- Design â#¢ Analyse, evaluate, and discuss existing fabrication sequences and manufacturing strategies.
- Analyze
- Assess / Evaluate
- Discuss

Teaching methods

The course combines several pedagogical approaches:

- Lectures delivered by faculty members.
- Self-paced learning through a dedicated MOOC.
- Student-led tutorials (SLTs).
- Online self-assessment quizzes.
- Guest lectures from industry representatives presenting real-world applications.

Expected student activities

Students are expected to:

- Attend lectures, complete the MOOC modules, and prepare questions in advance.
- Participate actively in 4 student-led tutorial (SLT) sessions.
- Prepare and present solutions during SLTs when selected; this component contributes 25% of the final grade. Take part in the group discussion and provide feedback to other students' presentations.
- Engage with the online discussion forum to interact with peers, teaching assistants, and instructors.
- Use the dedicated RAG Tutor bot containing cleanroom-specific process knowledge and in-house fabrication data.

Assessment methods

- Student-led tutorial participation and quality of contributions: 25% of the final grade.
- Written examination (January session): 75% of the final grade.

Supervision

Office hours	Yes
Assistant.e.s	Yes
Forum	Yes

Resources

Virtual desktop infrastructure (VDI)

No

Notes/Handbook

- MOODLE platform
- MOOC materials and handouts
- Guest lecture notes and supporting material

Websites

- https://go.epfl.ch/MICRO-331
- https://www.edx.org/course/micro-nanofabrication-mems-epflx-memsx-0
- https://go.epfl.ch/MICRO-303

Moodle Link

- https://go.epfl.ch/MICRO-303

Prerequisite for

MICRO-304