MICRO-331

Microfabrication technologies

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Cursus	Sem.	Type
Biomedical technologies minor	H	Opt.
Microtechnics	BA5	Obl.
Photonics minor	H	Opt.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	Oral
Workload	120h
Weeks	14
Hours	**4 weekly**
Lecture	4 weekly
Number of positions	

Summary

The student will learn process techniques and applications of modern micro- and nanofabrication, as practiced in a clean room, with a focus on silicon, but also multi-material microsystems and flexible/stretchable systems technologies.

Content

MOOC content
1. Cleanroom basics
2. Overview of successful Microsystems (MEMS)
3. Bi-morph cantilever as case study
4. Chemical Vapor Deposition (CVD)
5. Physical Vapor Deposition (PVD)
6. Lithography (UV and electron beam)
7. Dry etching
8. Wet etching
9. Inspection & Metrology

Ex-cathedra content:
1. IC history, basics of transistor fabrication
2. Storage systems (Hard-Disk magnetic storage system, solid state memory)
3. MEMS Displays
4. Mechanical MEMS and NEMS
5. Nanoscale systems
6. Flexible electronics
7. Implantable electroncs

Keywords

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

Learning Prerequisites

Required courses

Knowledge in physics and chemistry required to be able to understand the fundamentals of fabrication processes.

Recommended courses

Physics
Chemistry
Electronics

Important concepts to start the course

We all are using ubiquitously high-technology devices that help us in our daily routines (smart-phones, tablet, computer, smart watches, pacemaker, implanted electrodes, sensors in the cars and airplanes, biosensors, etc). They are all made by advanced micro and nanofabrication methods in sophisticated cleanroom/manufacturing/assembly centers. This course presents the basics of those fabrication steps so that you are prepared in case you are interest to join a company in this field of activity, or are interested in performing R&D.

Learning Outcomes

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

- Select appropriately the right order of the fabrication sequence
- Classify various fabrication methods
- Apply various fabrication steps as function of materials involved.
- Organize the order of the process flow accordingly to the materials compatility and system design.

Transversal skills

- Plan and carry out activities in a way which makes optimal use of available time and other resources.
- Evaluate one's own performance in the team, receive and respond appropriately to feedback.

Teaching methods

Ce cours est donné en partie par un MOOC et en partie ex cathedra.
Les premières ~9 semaines seront donné par le MOOC (2h hebdomadaire de lesson, + travail d'exercises et quiz + heures de classes avec les Professeur(e)s et les TA).
Les dernières semaines seronts donner par les Professeur(e)s qui présentent des applications modernes réalisé avec les techniques de fabrication étudiés dans ce cours (MEMS, bioMEMS, wearables, implantables, nanosensors, etc).

Expected student activities

Les etudiants suivent le MOOC et prepare le contenu des chapitres du cours avant l'heure ex-cathedra (flipped classroom), pour etre au mieux preparer et pouvoir poser des questions et participer a la discussion.
Un forum de Q&A est mis a disposition aux etudiants qui sont invité d'y poser des questions (aussi de facons anonymes).

Assessment methods

Grades quizzes during the semester.
Oral exam in January.

Supervision

Assistants	Yes
Forum	Yes

Resources

Virtual desktop infrastructure (VDI)

No

Notes/Handbook

Tout material sera mis a disposition sur le MOODLE.
Materiel du MOOC.
Handsout/script pour la partie ex-cathedra.

Moodle Link

- https://go.epfl.ch/MICRO-331

Videos

- https://www.edx.org/course/micro-nanofabrication-mems-epflx-memsx-0