

MICRO-530

Nanotechnology

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Cursus	Sem.	Type
Microtechnics	MA2, MA4	Obl.
Microtechnics	MA2, MA4	Opt.

Language of teaching	English
Credits	3
Session	Summer
Semester	Spring
Exam	Oral
Workload	90h
Weeks	14
Hours	3 weekly
Courses	3 weekly
Number of positions	

Summary

This course gives the basics for understanding nanotechnology from an engineer's perspective: physical background, materials aspects and scaling laws, fabrication and imaging of nanoscale devices.

Content**Nanoscale phenomena**

- Nanoscale phenomena: basic considerations
- Atomic structure & molecular structure & band structure
- Intermolecular forces & adsorption
- Examples of nanoscale phenomena

Nano-fabrication & nanoscale imaging

- Nanolithography for R&D prototyping
- Nanolithography for industry
- Nanoscale imaging

Keywords

Nanotechnology, quantum phenomena, materials, nanofabrication, lithography, fluidics, self-assembly, materials properties, characterisation, microscopy, nanoprobes

Learning Prerequisites**Required courses**

- Physics (basics of electromagnetism)

Recommended courses

- Microstructuration / MEMS
- Chemistry (basics)

Learning Outcomes

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

- Define the quantum physics origin of nanoscale effects
- Discriminate between different mechanisms influencing properties of nanomaterials and nanostructures and the involved length scales
- Describe the principal nanofabrication techniques
- Derive interactions between nano-scale objects
- Compare the different available methods for nanostructure characterisation & observation, as well as their advantages/disadvantages
- Synthesize the effects of quantum physics on nano-scale physicochemical properties
- Propose a nanofabrication technique and process optimisations

Transversal skills

- Assess one's own level of skill acquisition, and plan their on-going learning goals.
- Access and evaluate appropriate sources of information.

Teaching methods

Ex-cathedra course

Assessment methods

Oral exam

Resources

Bibliography

See bibliography in coursebook

Ressources en bibliothèque

- [Physical Chemistry / Atkins](#)
- [Intermolecular and surface forces / Israelachvily](#)

Notes/Handbook

Slides will be made available on the MOODLE MICRO 530 (see link below)

Students without any background in micro and nanofabrication can follow the EPFL EDX MOOC lecture on MEMS to get the basics in cleanroom fabrication techniques (see link below)

Websites

- <https://www.edx.org/course/micro-nanofabrication-mems-epflx-memx-0>

Moodle Link

- <https://moodle.epfl.ch/course/view.php?id=1301>