

Nanomanufacturing

Code: 103306
ECTS Credits: 6

Degree	Type	Year	Semester
2501922 Nanoscience and Nanotechnology	OB	4	1

Contact

Name: Francesc Torres Canals
Email: Francesc.Torres@uab.cat

Use of languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Teachers

Joan Bausells Roigé
Marta Fernandez Regulez
Xavier Borrise Nogué

Prerequisites

It is recommended to have passed the subjects of the three previous courses, especially those related to the areas of physics, engineering and electronics.

Objectives and Contextualisation

The objective of the module is to present the techniques and methods that exist of manufacture at a micro- and nanometric scale, so that the student will be capable of defining an appropriate sequence of processes for the realization of any type of device or functional structure. The content is focused on the manufacture of structures and functional devices, and not on the obtaining of materials. There will be practical and varied examples of fabrication of nanometric structures and devices (nanomechanical structures, graphene-based devices, nanosensors, photonic devices, micro / nano fluidic, etc.). An introduction to the operation and execution of processes will also be carried out in Clean Room.

Content

The subject is divided into four main blocks:

Module 1. Planar technology (10 h.T, 5 h.P)

The main processes of planar technology are described individually and the general aspects of micro / nano electronics technology are presented, as well as their evolution (miniaturization)

Introduction to planar technology: concept, wafers, sequence of processes, etc.
Individual technological processes: deposition (PVD and CVD), engravings (dry and wet), thermal processes, implantation, lithography.

Integration of processes, CMOS technology.
Evolution and limits of micro / nano electronics

Module 2. Nanolithography and "nanopatterning" (8 h.T, 4 h.P)

Lithography and nanopatterning techniques are described for the definition of nanostructures and nanodevices in surfaces. Examples of the current state of the art are presented.

- Advanced optical lithography
- Lithography by electron beam
- Lithography by ion beam
- Nanoimprint lithography
- Nanofabrication through SPMs
- Other nanolithographies

Module 3 Nanofabrication "bottom-up" (6h.T)

We describe methods for performing nanostructures and devices based on a "bottom-up" approach, based on the assembly of individual nanometric elements to build structures and functional devices.

- Self assembly and guided self assembly.
- Structures and devices based on nanowires and nanotubes
- Structures and devices based on nanoparticles
- DNA Origami
- Other methods of chemical and electrochemical manufacturing

Module 4 Practical work on nanofabrication

The student is introduced to the principles of operation of a Clean Room, there are practical demonstrations of micro and nano manufacturing processes. The design methodology for masks and micro-chips is introduced.

- Design of a mask with a dedicated editing program. (6 h)
- Visit to a Clean Room (2 hours)

In addition, 5 hours of seminars have been planned with researchers specializing in nanofabrication.