Universitat Autònoma de Barcelona

2021/2022

Advanced Nanomanufacturing

Code: 43439
ECTS Credits: 6

Degree	Type	Year	Semester
4314939 Advanced Nanoscience and Nanotechnology	OT	0	A

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

Contact

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Use of Languages

Principal working language: english (eng)

Teachers

Francesc Torres Canals

External teachers

Francesc Pérez Murano

Gemma Rius Suñé

Joan Bausells

Xavier Borrise Nogué

Prerequisites

It is advisable to have prior knowledge of Nanofabrication

Objectives and Contextualisation

• To know in depth the most common methods of nanostructuring of surfaces.

• Understand in detail the performance and limitations of the main methods of lithography.

• To enable students to design a process for the fabrication of devices and nanostructures.

• Gain practical knowledge on the use of nanofabrication equipment.

• Know the state of the art in nanofabrication and the main directions of the current evolution lines of this discipline.

Competences

- Communicate and justify conclusions clearly and unambiguously to both specialised and non-specialised audiences.
- Identify and distinguish the synthesis/manufacture techniques for nanomaterials and nanodevices typically adopted in one's specialisation.
- Show expertise in using scientific terminology and explaining research results in the context of scientific production, in order to understand and interact effectively with other professionals.
- Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
- Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.

Learning Outcomes

1. Appreciate autoassembly as a way of manufacturing nanostructures.
2. Communicate and justify conclusions clearly and unambiguously to both specialised and non-specialised audiences.
3. Identify the steps involved in a process of nano-printing using moulds.
4. Show expertise in using scientific terminology and explaining research results in the context of scientific production, in order to understand and interact effectively with other professionals.
5. Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
6. Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
7. Use an electron-beam lithography tool and carry out a technological process.

Content

- In-depth description of the main methods of nanofabrication, both top-down and bottom-up. Training for the use of equipment and work in Clean Room.

- Lithography Electron beam dose calculation. Selection of resists. Methods of alignment. Mix and Match with other techniques. Operation of software and equipment. Practical realization of nanodevices. Post-processing

- Nanostructuring by replication. Design and manufacture of molds. Practical realization of nanostructures.

- Bottom-up strategies. Preparation of layers. Selective deposition techniques and self-organization. Surface functionalization. Growth of nanostructures.

Methodology

- Lectures / Lectures
- Laboratory Practices
- Problem-based Learning
- Tutorials
- Personal work / reports
- Reading research articles
- Seminars

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Laboratory Practices	10	0.4	
Lectures	10	0.4	4
Problem-based Learning	6	0.24	
Type: Supervised			
Process design	25	1	
Type: Autonomous			
Personal work / reports / Autonomous lab work	40	1.6	4, 2
Reading research articles and state-of-the art literature	20	0.8	
Seminars	5	0.2	

Assessment

It will be evaluated the student's ability to perform a complete nanofabrication process, from the design and selection of individual processes, to the implementation and final characterization. There will be special emphasis on the documentation submitted and analytical skills of the students.

It is possible to have the chance to increase the mark of the synthesis exam in an extra test (only for those students that has carried out all previous evaluations along the course, irrespective of the marks).

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Delivery of reports	10 %	20	0.8	4
Exams	30 %	2	0.08	5, 6
Oral presentation of work	25 %	2	0.08	4, 2
Practical works realization	40 %	10	0.4	1, 3, 7

Bibliography

Research articles (proposed by teachers as a result of research literature by students)

Manuals teams

Datasheets materials

Books nanofabrication

Software

Use of free software to dessign micro(nano)structures.