

Course guide

230484 - NTECH - Nanotechnology

Last modified: 25/05/2023

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering.
713 - EQ - Department of Chemical Engineering.

Degree: BACHELOR'S DEGREE IN ENGINEERING PHYSICS (Syllabus 2011). (Optional subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish, English

LECTURER

Coordinating lecturer: Consultar aquí / See here:
<https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/responsables-assignatura>

Others: Consultar aquí / See here:
<https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/professorat-assignat-idioma>

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

4. Knowledge of matter properties at the nanoscale. Knowledge of nanomaterials synthesis methods and nanodevices production. Ability to use technology manipulation of matter at the nanoscale. Knowledge of nanotechnology applications.

Generical:

3. ABILITY TO IDENTIFY, FORMULATE, AND SOLVE PHYSICAL ENGINEERING PROBLEMS. Planning and solving physical engineering problems with initiative, making decisions and with creativity. Developing methods of analysis and problem solving in a systematic and creative way.

Transversal:

1. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.
2. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

TEACHING METHODOLOGY

Lectures are provided by the course professors, who presents the essential course contents to the students.
Not all course contents will be taught in the lecture sessions, so autonomous study is required.

LEARNING OBJECTIVES OF THE SUBJECT

Introduction to Principles, Fabrication Methods, and Applications of Nanotechnology

STUDY LOAD

Type	Hours	Percentage
Hours large group	65,0	43.33
Self study	85,0	56.67

Total learning time: 150 h

CONTENTS

1 Nanomaterials

Description:

- . Nanomaterials
 - 1.1. Introducció
 - 1.2. Preparation Techniques
 - 1.2.1. Gas phase
 - 1.2.2. Liquid phase
 - 1.2.3. Microfluidics
 - 1.2.4. Carbon Nanotubes

Full-or-part-time: 11h 40m

Theory classes: 3h 05m

Practical classes: 1h 55m

Self study : 6h 40m

2 Characterization Techniques

Description:

- 2.1. UV-Vis and Fluorescence Spectroscopy
- 2.2. X-Ray Diffraction
- 2.3. Transmission Electron Microscopy
- 2.4. AFM/STM
- 2.5. X-Ray Photoelectron Spectroscopy

Full-or-part-time: 11h 40m

Theory classes: 3h 05m

Practical classes: 1h 55m

Self study : 6h 40m

3. Reactivity of surfaces

Description:

- 3. Reactivity
 - 3.1. Catalysis
 - 3.2. Photonic properties

Full-or-part-time: 23h 20m

Theory classes: 6h 10m

Practical classes: 3h 50m

Self study : 13h 20m



4 Fabrication and preparation

Description:

- Top-down and bottom-up.
- Lithographies: Optical (UV, DUV), e-beam litho, AFM based litho, Nanoimprint.
- Growth of films.

Full-or-part-time: 17h 30m

Theory classes: 4h 35m

Practical classes: 2h 55m

Self study : 10h

5 Molecular devices

Description:

- 1_ Why electrons flow
- 2_ Solar cells
- 3_ Thin-Film Transistors (TFTs)
- 4_ Quantum Dot conductivity

Full-or-part-time: 29h 10m

Theory classes: 7h 40m

Practical classes: 4h 50m

Self study : 16h 40m

GRADING SYSTEM

Written exam

Partial exam (EP) (50%) + Final Exam (EF) (50%) + Presentation of the report (PT) (10%)

In case you need to recover the partial exam, the grade will be Max (+0.5 0.4EF EP; 0.9EF) +0.1 Report (PT)

BIBLIOGRAPHY

Basic:

- Somorjai, G.A. Introduction to Surface Chemistry and Catalysis. 2nd.ed. Wiley Interscience, 2010. ISBN 9780470508237.
- Kelsall, R.; Hamley, I.; Geoghegan, M. Nanoscale science and technology [on line]. Chichester: John Wiley & Sons, 2005 [Consultation: 22/01/2015]. Available on: <http://onlinelibrary.wiley.com/book/10.1002/0470020873>. ISBN 9780470020876.