COURSE: NANOTECHNOLOGY

SUBJECT: Nanotechnology
MODULE: Process and Product Engineering
PROGRAM: Master's degree in Chemical Engineering

GENERAL CHARACTERISTICS*

Type: ☐ Basic formation, ☐ Compulsory, ☑ Optional

☐ Master Thesis, ☐ Internship

Duration: Semestral **Semester / s**: 2
Number of ECTS credits: 3
Languages: English, Catalan, Spanish

DESCRIPTION

BRIEF DESCRIPTION AND JUSTIFICATION

The behavior of the materials at nanometric scale may be different than at a macroscopic scale. The main models and theories that explain nanometric phenomena are presented, with special emphasis on the difference of properties as a function of the mass of the material.

Likewise, numerous applications, new materials and highly tup-to-date systems are shown, whose functionality is explained by the presented models. These chemical systems are the result of constant evolution and new requirements of society and industry.

COMPETENCES

CB6 – The student has knowledge and understanding of what constitutes a basis or an opportunity to be original by developing and/or applying ideas, often in a research context.

CB7 - The student can apply their knowledge and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to his/her field of study.

CB8 - The student is able to integrate knowledge and handle complexity involving judgments based on incomplete or limited information, including issues on social and ethical responsibilities linked to the application of his/her knowledge and judgments.

CT5 - The student is able to assess the impact of Chemical Engineering in the sustainable development of society.

CE2 - The student can design products, processes, systems and services for the chemical industry as well as optimize other already developed, on the technological basis the various areas of Chemical Engineering, involving processes and transport phenomena, separation operations and reactor engineering, both chemical and nuclear, electrochemical or biochemical.

CE4 - The student has the ability to solve problems that are unfamiliar, incompletely defined, and have contradictory specifications, considering the possible methods of solution, including the most

innovative, selecting the most appropriate, being able to correct implementation and evaluating the different design solutions.

PREREQUISITES*

The competencies of the fundamental module.

CONTENTS

1. The energy at the nanoscale.
2. Properties nano vs. micro or continuous medium.
3. Nanometric structures: top-down and bottom-up strategies.
4. Nanometric characterization: microscopy and other techniques.
5. Nanomaterials and their applications: carbon-based (clusters, wires, nanotubes, fullerene and graphene), nanoparticles, nanostructured continuous materials, organic compounds and polymers, nanocomposites and others.
6. Nanotechnology: nanometric devices, nanomachines, nanofabrication and nanobiological applications.

METHODOLOGY

LEARNING ACTIVITIES *

Learning Activities	ECTS Credits	Competences
Lectures	0.5	CB6, CB7, CB8, CE2, CE4
Case and Problem-Solving Sessions	0.5	CB6, CB78, CE2, CE4
Seminars	0.1	CG1
Personal Study	1.8	CB6, CB7, CB8, CE2, CE4
Assessment Tasks (Exams, Continuous Assessment...)	0.1	CB6, CB7, CB8, CE2, CE4
TOTAL	**3**	

TEACHING METHODOLOGY

The teaching methodology used in this course is based on lectures and Case and Problem-Solving Sessions. Seminars are also programmed to solve doubts. The student is provided with the complete course documentation with theory and case documents for personal study.

Problem-Solving Sessions constitute a complement to the lectures and allow the development of the critical capacity and the practice to solve, independently, other problems. In these sessions we propose the accomplishment of projects or problems.

The students themselves prepare group presentations or individually on specific topics, which become part of the study material

ASSESSMENT

ASSESSMENT METHODS *

Assessment methods	Weight	Competences
Final Exam	40%	CB6, CB7, CB8, CE2, CE4, CG1, CT5
Continuous Assessment Activities	20%	CB6, CB7, CB8, CE2, CE4
Reports and Presentations	30%	CB6, CB7, CB8, CE2, CE4
Participation	10%	E4

LEARNING OUTCOMES

- The student must demonstrate knowledge that gives him the base or opportunity to be original in the development and / or application of ideas [CB6].
- The student must know how to apply the knowledge acquired and his ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to his area of study [CB7]
- The student must demonstrate ability to integrate knowledge and face the complexity of making judgments based on information that, being incomplete or limited, includes reflections on the social and ethical responsibilities linked to the application of their knowledge and judgments [CB8].
- The student must know how to design, manage, perform and present a project and capacity to assess the impact of Chemical Engineering on the sustainable development of society [CG1, CT5].
- The student must know how to design products, processes, systems and services of the chemical industry, as well as the optimization of others already developed, taking as a technological base the various areas of chemical engineering, comprehensive processes and transport phenomena, separation operations and engineering of chemical, nuclear, electrochemical and biochemical reactions [CE2].
- The student must have the ability to solve problems that are unfamiliar, incompletely defined, and have competing specifications, considering the possible methods of solution, including the most innovative ones, selecting the most appropriate one, and being able to correct the implementation, evaluating the different design solutions [CE4]

QUALIFICATION

The evaluation of the course will consider all aspects listed in the evaluation table with its corresponding weight. The main weight of the grade lies in the final examination (40%). The reports and Presentations include classroom presentations and specific monographs that students prepare (30%). Follow-up activities include midterm exams or other deliverables (20%). Participation (10%) includes attitude, attendance and initiative shown by the student in the subject.

ASSESSMENT OF THE COMPETENCES (Define calculation expressions for each competency based assessment activities related.)

The evaluation of the competences is carried out through specific items of the different evaluation methods used.

BIBLIOGRAPHY (Recommended and accessible to students.)

- Nanoscale Science and Technology, Eds. R. W. Kelsall, I. W. Hamley, M. Geoghegan, Wiley, 2005, West Sussex (England). ISBN 0-470-85086-8.

DOCUMENT HISTORY

PREVIOUS CHANGES
September 20, 2016, Carles Colominas i Guardia
September 15, 2014, Carles Colominas i Guardia

CURRENT REVISION
6 March 2019, Carles Colominas i Guardia

* These features should not be modified without the approval of the bodies responsible for academic higher-level structures (field, module and / or system).