



POLITÉCNICA

INTERNATIONAL
CAMPUS OF
EXCELLENCE

COORDINATION PROCESS OF
LEARNING ACTIVITIES
PR/CL/001



E.T.S. de Ingenieros de
Caminos, Canales y Puertos

ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

43000624 - Introducción A La Investigación En Ciencia E Ingeniería De Materiales - Materiales Funcionales

DEGREE PROGRAMME

04AN - Master Universitario En Ingeniería De Materiales

ACADEMIC YEAR & SEMESTER

2023/24 - Semester 2

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1. Description

1.1. Subject details

Name of the subject	43000624 - Introducción a la Investigación en Ciencia e Ingeniería de Materiales - Materiales Funcionales
No of credits	3 ECTS
Type	Optional
Academic year of the programme	First year
Semester of tuition	Semester 2
Tuition period	February-June
Tuition languages	English
Degree programme	04AN - Master Universitario en Ingeniería de Materiales
Centre	04 - Escuela Técnica Superior De Ingenieros De Caminos, Canales Y Puertos
Academic year	2023-24

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Fernando Calle Gomez (Subject coordinator)		fernando.calle@upm.es	- -

* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

The subject - recommended (passed), are not defined.

3.2. Other recommended learning outcomes

- All obligatory modules in the first quarter, and most modules of the itinerary/route of Functional Materials
- Oral and written English

4. Skills and learning outcomes *

4.1. Skills to be learned

CB06 - Poseer y comprender conocimientos que aporten una base u oportunidad de ser originales en el desarrollo y/o aplicación de ideas, a menudo en un contexto de investigación

CB08 - Que los estudiantes sean capaces de integrar conocimientos y enfrentarse a la complejidad de formular juicios a partir de una información que, siendo incompleta o limitada, incluya reflexiones sobre las responsabilidades sociales y éticas vinculadas a la aplicación de sus conocimientos y juicios

CB09 - Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades

CE4 - Autonomía para adquirir, analizar, actualizar y aplicar nuevos conocimientos, modelos y técnicas experimentales y numéricas en relación con la composición y estructura de los materiales, su caracterización física y química, sus procesos de fabricación, su utilización y aplicación científica y tecnológica, y su reciclado, reutilización y eliminación / Autonomy to acquire, analyze, update and apply new knowledge, models and experimental and numerical techniques related to the composition and structure of materials, their physical and chemical characterization, their manufacturing processes, their use and scientific and technological application, and their recycling, reuse and disposal

CE8 - Aplicación del método científico para la resolución de problemas y la generación de conocimiento / Application of the scientific method to solve problems and generate knowledge

CG1 - Uso de la lengua inglesa: Los alumnos son capaces de transmitir conocimientos y expresar ideas y argumentos de manera clara, rigurosa y convincente, tanto de forma oral como escrita, adaptándose a las características de la situación y de la audiencia / Use of the English Language: Students are able to transmit knowledge and express ideas and arguments in a clear, rigorous and convincing manner, both orally and in writing, adapting to the characteristics of the situation and the audience .

CG3 - Trabajo en equipo: Los alumnos desarrollan la capacidad para trabajar en equipo, integrarse y colaborar de forma activa en la consecución de objetivos comunes / Teamwork: Students develop the ability to work as a team, integrate and actively collaborate in achieving common goals.

CG9 - Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades

4.2. Learning outcomes

RA1 - Saber comunicar conocimientos, procedimientos, resultados o técnicas relacionadas con el comportamiento y el uso de materiales

RA4 - Que los estudiantes sepan comunicar sus conclusiones (y los conocimientos y razones últimas que las sustentan) a públicos especializados y no especializados de un modo claro y sin ambigüedades

RA11 - knowledge of the basic fabrication methods, structure and properties of nanomaterials and other forms of nanostructured hybrids

RA16 - Knowledge and understanding of the electrical, optical, thermal and mechanical properties of materials

RA3 - Conocer, comprender y saber aplicar las bases de la ciencia y del método científico

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

Due to its short duration and very broad topic, as well as its evolving content, the main objective of this module is to provide a first approach to the research and innovation, and the state of the art in electronic and functional materials.

The contents of the course are listed in the table below. They will include an introduction to research and innovation and research methodology (research projects, documentation of results, outreach). Many talks will be given by experts on specific research fields, on different topics from ICT, energy and biotechnology. The students will have also a description and visit to clean room facilities. to be variable, though a list of intended topics is given below.

A cooperative and active methodology will be used. Student participation will include assistance to lectures and to discussion sessions afterwards. In addition, within the framework of this module, the students will write a paper on a specific topic suggested or approved by the professor, and present it in class.

Student-speaker and student-student interactions will be favored by means of discussion during the sessions and debates afterwards.

Office hours give students the opportunity to explore different topics of interest and to ask in-depth questions on their papers and presentations. They will take place after the sessions or in any time after agreement student-coordinator.

This module will be performed in an intensive timetable, 4 h/week, during the first half of the second semester.

5.2. Syllabus

1. Emerging technologies, research, innovation and foresight
2. Research methodology: scientific method, research projects, results and documentation
3. Invited talks on functional materials and applications
4. Description and visit to clean room facilities
5. Workshop on Functional Materials (student`s teamworks)
6. Debate: Drivers and future scenarios

6. Schedule

6.1. Subject schedule*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	Emerging technologies, research, innovation and foresight Duration: 04:00 Lecture			
2	Research methodology Duration: 04:00 Lecture			
3	Invited talks on functional materials and applications (1) Duration: 04:00 Lecture			
4	Invited talks on functional materials and applications (2) Duration: 04:00 Lecture			
5	Invited talks on functional materials and applications (2) Duration: 04:00 Lecture			Monitoring of previous sessions 1-5. Compulsory, non-recoverable activity Group presentation Continuous assessment and final examination Presential Duration: 00:00
6		Description and visit to clean room facilities Duration: 04:00 Laboratory assignments		
7	Workshop on Introduction to Research in Functional Materials (1,2) Duration: 04:00 Cooperative activities			
8	Workshop on Introduction to Research in Functional Materials (3) Duration: 02:00 Cooperative activities			Paper, presentation and monitoring of team works Compulsory, non-recoverable activity Group presentation Continuous assessment and final examination Presential Duration: 00:00
9				
10				
11				

12				
13				
14				
15				
16				
17				

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.

* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.

7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
5	Monitoring of previous sessions 1-5. Compulsory, non-recoverable activity	Group presentation	Face-to-face	00:00	30%	3 / 10	CB08 CG1 CG9 CB09 CB06 CE4
8	Paper, presentation and monitoring of team works Compulsory, non-recoverable activity	Group presentation	Face-to-face	00:00	70%	5 / 10	CB08 CB09 CG1 CG3 CG9 CB06 CE8 CE4

7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
5	Monitoring of previous sessions 1-5. Compulsory, non-recoverable activity	Group presentation	Face-to-face	00:00	30%	3 / 10	CB08 CG1 CG9 CB09 CB06 CE4
8	Paper, presentation and monitoring of team works Compulsory, non-recoverable activity	Group presentation	Face-to-face	00:00	70%	5 / 10	CB08 CB09 CG1 CG3 CG9 CB06 CE8 CE4

7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Monitoring of sessions 1-5. Compulsory, non-recoverable activity	Group presentation	Face-to-face	00:00	30%	3 / 10	CB08 CB09 CG1 CG9 CB06 CE4
Paper, presentation and monitoring of team works Compulsory, non-recoverable activity	Group presentation	Face-to-face	00:00	70%	5 / 10	CB08 CB09 CG1 CG3 CG9 CB06 CE8 CE4

7.2. Assessment criteria

Continuous and global evaluation

All students will be stimulated to participate in the debates during and after the talks by experts (weeks 2-5), and their comments/questions will be recorded and evaluated (30%).

Participation in a workshop will be valued 70%. The workshop will include contributions elaborated by 2-3 student teams (weeks 6-7). The works consist of a paper and a presentation. The progress of the students will be evaluated through their paper, presentation and monitoring of the workshop itself in weeks 6-7. The paper will be valued 20%; monitoring of another group and all presentations, 10%; own presentation, 40%.

All described activities are compulsory and cannot be recovered, as far as they contribute to the generic competencies and cannot be performed after the sessions.

Extraordinary evaluation

All students should have participated in the debates during and after the talks by experts (weeks 2-5), and their comments/questions will be recorded and evaluated (30%).

Participation in the workshop will be valued 70%. The workshop will include contributions elaborated by 2-3 student teams (weeks 6-7). The works consist of a paper and a presentation. The progress of the students will be evaluated through their paper, presentation and monitoring of the workshop itself in weeks 6-7. The paper will be valued 20%; monitoring of another group and all presentations, 10%; own presentation, 40%.

All described activities are compulsory and cannot be recovered, as far as they contribute to the generic competencies and cannot be performed after the sessions.

In all cases, a complementary evaluation might take place to guarantee that original work has been performed.

8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
Presentations in Moodle	Others	
Web pages	Web resource	
Videos	Others	

9. Other information

9.1. Other information about the subject

Some information on Sustainable Developments Goals of Nanoelectronics will be given in this module, in particular SDG3, 7, 9 and 11.