



POLITÉCNICA

INTERNATIONAL
CAMPUS OF
EXCELLENCE

COORDINATION PROCESS OF
LEARNING ACTIVITIES
PR/CL/001



E.T.S. de Ingenieros de
Telecomunicacion

ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

93000975 - Nanomedicine Technologies

DEGREE PROGRAMME

09AU - Master Universitario en Ingeniería Biomedica

ACADEMIC YEAR & SEMESTER

2020/21 - Semester 1

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1. Description

1.1. Subject details

Name of the subject	93000975 - Nanomedicine Technologies
No of credits	3 ECTS
Type	Optional
Academic year of the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	09AU - Master Universitario en Ingenieria Biomedica
Centre	09 - Escuela Tecnica Superior de Ingenieros de Telecomunicacion
Academic year	2020-21

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Milagros Ramos Gomez	A-219	milagros.ramos@upm.es	W - 13:00 - 14:00
Carlos Angulo Barrios (Subject coordinator)	A-219	carlos.angulo.barrios@upm.es	W - 13:00 - 14:00
Jose Javier Serrano Olmedo		josejavier.serrano@upm.es	Sin horario.

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

3. Skills and learning outcomes *

3.1. 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

CB07 - Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio

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

CB10 - Que los estudiantes posean las habilidades de aprendizaje que les permitan continuar estudiando de un modo que habrá de ser en gran medida autodirigido o autónomo.

CE-MIB01 - Utilizar el lenguaje especializado empleado en entornos biomédicos y los fundamentos de las ciencias biomédicas para su aplicación en la resolución de problemas médicos de la Ingeniería Biomédica.

CE-MIB07 - Utilizar los métodos y técnicas actuales en bioinstrumentación para el análisis y diseño de sistemas avanzados de diagnóstico, terapia y monitorización de pacientes

CG-MIB01 - Resolver problemas e integrar conocimiento en temas nuevos o escasamente definidos y en entornos multidisciplinares del área de la Ingeniería Biomédica

CG-MIB02 - Analizar y aplicar la reglamentación correspondiente a la sensibilidad social y ética en los ámbitos de operación que pueden darse en Ingeniería Biomédica

CG-MIB03 - Utilizar la filosofía, el método científico y el método experimental para la búsqueda de innovación, la curiosidad científica y el desarrollo de actitudes creativas

CG-MIB04 - Utilizar las tecnologías de la información y la comunicación para la búsqueda de información, datos bibliográficos y adquisición de nuevo conocimiento para la formación permanente y el trabajo autónomo

CG-MIB05 - Utilizar técnicas de expresión oral y escrita para comunicar trabajos y conclusiones a comunidades de

iguales o divulgación científica, elaboración de artículos, manuales de estilo y herramientas de edición para fomentar la capacidad de comunicación y disseminación de resultados

CG-MIB06 - Aplicar técnicas de trabajo colaborativo en equipos multidisciplinares internacionales y liderazgo, así como utilizar métodos para asumir la responsabilidad de orientar y dirigir trabajos científicos en el ámbito de la ingeniería Biomédica

CG-MIB07 - Utilizar la lengua inglesa como herramienta de trabajo

3.2. Learning outcomes

RA91 - Being able to apply advanced bioinstrumentation and biosensing technologies to the design and implementation of nanomedicine systems.

* 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.

4. Brief description of the subject and syllabus

4.1. Brief description of the subject

Topic 1. Introduction (1 lesson)

Topic 2. Optical nanobiosensors (2 lessons)

2.1. Metallic Nanoparticles

2.2. Semiconductor nanoparticles

2.3. Plasmonic films

2.4. Optical fiber probes

Topic 3. Lab-on-a-chip (2 lessons)

3.1. Introduction

3.2. Microfluidics

3.3. Applications

Topic 4. Biomedical applications of the nanotechnology (1 lesson)

4.1. Diagnostics (in vitro & in vivo)

4.2. Therapy

Topic 5. Nanotechnology and cancer (1 lesson)

5.1. Hyperthermia (HT): Cytotoxic effects

5.2. HT and nanotechnology: magnetic HT, optical HT y photodynamic therapy

5.3. Nanotechnology for drugs release

Topic 6. Nanotechnology for CNS diseases (1 lesson)

6.1. Crossing of the blood-brain barrier by nanoparticles

6.2. Nanomedicine for neurodegenerative diseases and ictus

Topic 7. Laboratory work in room A035 (1 lesson)

7.1. Internalization of NPs by fibroblasts cultures

7.2. Toxicity assessment of NPs in cellular cultures

Topic 8. Bioelectronics (2 lessons)

8.1. Nanoscale engineering of electrodes

8.2. Single molecule bioelectronics

Topic 9. Nanorobotics (1 lesson)

9.1. What is and what is not a nanorobot

9.2. Manufacturing approaches

9.3. Examples

4.2. Syllabus

1. Topic 1. Introduction
2. Topic 2. Optical nanobiosensors
3. Topic 3. Lab-on-a-chip
4. Topic 4. Biomedical applications of the nanotechnology
5. Topic 5. Nanotechnology and cancer
6. Topic 6. Nanotechnology for CNS diseases
7. Topic 7. Laboratory work
8. Topic 8. Bioelectronics
9. Topic 9. Nanorobotics

5. Schedule

5.1. Subject schedule*

Week	Face-to-face classroom activities	Face-to-face laboratory activities	Distant / On-line	Assessment activities
1	Lecture Duration: 02:00 Lecture Lecture Duration: 02:00 Lecture			
2	Lecture Duration: 02:00 Lecture Lecture Duration: 02:00 Lecture			
3	Lecture Duration: 02:00 Lecture Lecture Duration: 02:00 Lecture			
4	Lecture Duration: 02:00 Lecture Lecture Duration: 02:00 Lecture			
5	Lecture Duration: 02:00 Lecture	Laboratory assignments Duration: 02:00 Laboratory assignments		
6	Lecture Duration: 02:00 Lecture Lecture Duration: 02:00 Lecture			
7	Lecture Duration: 02:00 Lecture			Individual presentation Individual presentation Continuous assessment Presential Duration: 02:00

8				
9				Final examination Written test Final examination Presential Duration: 02:00 Continuous assessment Written test Continuous assessment Presential Duration: 02:00
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.

6. Activities and assessment criteria

6.1. Assessment activities

6.1.1. Continuous assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
7	Individual presentation	Individual presentation	Face-to-face	02:00	30%	5 / 10	CB09 CG-MIB04 CB10 CB06 CE-MIB07 CE-MIB01 CG-MIB07 CB08 CG-MIB05
9	Continuous assessment	Written test	Face-to-face	02:00	70%	5 / 10	CG-MIB04 CB07 CB10 CB09 CB06 CE-MIB07 CE-MIB01 CG-MIB07 CG-MIB03 CB08 CG-MIB06 CG-MIB05 CG-MIB01 CG-MIB02

6.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
9	Final examination	Written test	Face-to-face	02:00	100%	5 / 10	CG-MIB04 CB07 CB10 CB09 CB06 CE-MIB07 CG-MIB07 CG-MIB06 CG-MIB02 CG-MIB01 CE-MIB01 CG-MIB03

							CB08 CG-MIB05
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6.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Extraordinary examination	Written test	Face-to-face	02:00	100%	5 / 10	CB10 CB09 CB06 CG-MIB04 CB07 CE-MIB07 CE-MIB01 CG-MIB07 CG-MIB03 CB08 CG-MIB06 CG-MIB05 CG-MIB01 CG-MIB02

6.2. Assessment criteria

By default, students will be evaluated via continuous assessment. If a student wants to renounce continuous assessment and chooses to be evaluated through final examination, he/she must inform the coordinator about it by means of a written document by three weeks before the end of the course.

Continuous, final and extraordinary assessments will check whether the students have acquired the subject skills. The extraordinary examination will be achieved through a single written test.

7. Teaching resources

7.1. Teaching resources for the subject

Name	Type	Notes
Class slides	Others	Class slides will be uploaded to Moodle
Bibliography	Bibliography	Specific bibliography will be provided for each chapter/topic