ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

93000988 - Regenerative Medicine

DEGREE PROGRAMME

09AU - Master Universitario En Ingenieria Biomedica

ACADEMIC YEAR & SEMESTER

2023/24 - Semester 2

Index

Learning guide

1. Description

1.1. Subject details

Name of the subject	93000988 - Regenerative Medicine
No of credits	3 ECTS
Type	Optional
Academic year ot the programme	First year
Semester of tuition	Semester 2
Tuition period	February-June
Tuition languages	English
Degree programme	09AU - Master Universitario en Ingenieria Biomedica
Centre	09 - Escuela Tecnica Superior De Ingenieros De Telecomunicacion
Academic year	2023-24

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Blanca De Los Reyes Gonzalez Bermudez	CC.Mat-ETSICCP	blanca.gbermudez@upm.es	Th - 11:00 - 14:00 Ask for an specific date by email
Francisco Javier Rojo Perez (Subject coordinator)	CC.Mat-ETSICCP	fj.rojo@upm.es	Tu - 15:00 - 18:00 Ask for an specific date by email

Nuria Mari Buye	CC.Mat-ETSICCP	nuria.mari@upm.es	Th - 17:00 - 19:00 Ask for an specific date by email

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

2.3. External faculty

Name and surname	Email	Institution
Mónica Echeverry	monica.echeverry@imdea.org	Imdea Materiales

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.

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 diseminación 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

RA36 - Análisis y selección de los grupos de biomateriales y materiales biológicos más relevantes en ingeniería biomédica (ortopedia, odontología, cardiología, oftalomología, cirugía).

RA37 - Análisis y selección de metales, cerámicos, polímeros en biomateriales naturales.

RA38 - Análisis y selección de métodos y técnicas más actuales para modelar su estructura, propiedades, obtención y procesado y su aplicación en ingeniería de tejidos

* 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

Regenerative medicine involves the repair and regeneration of tissues for therapeutic purposes.

Regenerative medicine tries to mimic the natural processes in tissue development and the intrinsic healing mechanisms of the bodies.

In this course the students will learn about regenerative medicine and tissue engineering from basics to more sophisticated applications.

The students will be given a basic introduction on stem cells and how they differentiate. Also, they will explore biomaterials and their role in tissue engineering and regenerative medicine, providing a deep knowledge in the cell-biomaterial interaction. The students will also study the mechanisms and limitations underlying cell therapies with mesenchymal stem cells and immunomodulatory therapies. It will be provided an overview on bioreactors for cell productions and different tissue engineering strategies. Later, the lectures will be focused on specific applications in tissue engineering and cell therapy, provided by professionals working in the field.

4.2. Syllabus

1. Introduction to Regenerative Medicine.

2. Cell types. Differentiation. Development.

3. Basics of cell culture

4. Cell-biomaterial interactions I

5. Cell-biomaterial interactions II

6. Scaffolds. Functionalization

7. Cell therapy: mesenchymal stem cells and CART cells

8. Bioreactors

9. Other tissue engineering strategies

10. Applications in regenerative medicine: stents / tissue engineered blood vessels

11. Applications in regenerative medicine: professional seminars

5. Schedule

5.1. Subject schedule*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	**Introduction to Regenerative Medicine** Duration: 02:00 Lecture			
2	**Cell types. Differentiation. Development** Duration: 02:00 Lecture			
3	**Basics of cell culture** Duration: 02:00 Lecture			
4	**Interaction Cell-Biomaterial I** Duration: 02:00 Lecture			
5	**Interaction Cell-Biomaterial II** Duration: 02:00 Lecture			
6	**Scaffolds. Functionalization** Duration: 01:00 Lecture		**Journal club** Duration: 01:00 Additional activities	
7	**Cell therapy: mesenchymal stem cells and CART cells** Duration: 02:00 Lecture			
8	**Bioreactors** Duration: 02:00 Lecture			
9	**Other tissue engineering strategies** Duration: 02:00 Lecture			
10	**Applications in regenerative medicine: stents / tissue engineered blood vessels** Duration: 02:00 Lecture			
11	**Applications in regenerative medicine: professional seminar** Duration: 02:00 Lecture			
12	**Applications in regenerative medicine: professional seminar** Duration: 02:00 Lecture			

13	**Applications in regenerative medicine: professional seminar** Duration: 02:00 Lecture			
14	**Applications in regenerative medicine: professional seminar** Duration: 02:00 Lecture			
15				**Group presentations** Group presentation Continuous assessment Presential Duration: 02:00
16				**Exam** Written test Continuous assessment Presential Duration: 02:00
17				**Final exam** Written test Final examination Not Presential Duration: 02:00

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. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
15	Group presentations	Group presentation	Face-to-face	02:00	40%	4 / 10	CB06 CB07 CB09 CB08 CB10 CG-MIB04 CG-MIB05 CG-MIB06 CG-MIB07 CG-MIB02
16	Exam	Written test	Face-to-face	02:00	60%	4 / 10	

6.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Final exam	Written test	No Presential	02:00	100%	5 / 10	CB06 CB07 CB09 CB08 CB10 CG-MIB04 CG-MIB05 CG-MIB07 CG-MIB02

6.1.3. Referred (re-sit) examination

No se ha definido la evaluación extraordinaria.

6.2. Assessment criteria

Ordinary evaluation

The evaluation of students will be based on 2 main points:

- An oral presentation of a particular topic of the subject (40% weight)

PASS MARK >= 4

- A final written exam (60% weight)

PASS MARK >= 4

Extraordinary evaluation

Only final exam with a total weight of 100%.

Pass mark: EX >= 5

For ordinary and extraordinary evaluation, a minimum average score of 5 is required.

7. Teaching resources

7.1. Teaching resources for the subject

Name	Type	Notes
Lecciones de Materiales Biológicos y Biomateriales	Bibliography	J. Pérez-Rigueiro. Ingebook Libros electrónicos (2007).
Molecular Biology of the Cell	Bibliography	Alberts B, Johnson A, Lewis J, et al. New York: Garland Science; 2002.
Principles of Regenerative Medicine	Bibliography	Atala A, Lanza R, Thomson J. A. and Nerem R. M. Boston: Elsevier; 2011.
Biomedical Engineering. Bridging Medicine and Technology	Bibliography	Saltzman W. M. Cambridge University Press; 2009.

8. Other information

8.1. Other information about the subject

In a normal situation the Evaluation Activities and classes will be done presentially.

In case the Chief of Studies says so, all the activities will be done telematically with no significant changes either in the contents or in the schedule.