ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

93000961 - Biomedical Technologies Design

DEGREE PROGRAMME

09AU - Master Universitario En Ingenieria Biomedica

ACADEMIC YEAR & SEMESTER

2023/24 - Semester 1

Index

Learning guide

1. Description

1.1. Subject details

Name of the subject	93000961 - Biomedical Technologies Design
No of credits	3 ECTS
Type	Compulsory
Academic year ot 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	2023-24

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Juan Jose Gomez Valverde	C-203	juanjo.gomez@upm.es	Th - 10:00 - 11:00
Maria Jesus Ledesma Carbayo (Subject coordinator)	C-201	mj.ledesma@upm.es	Th - 13:00 - 14:00

* 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-MIB04 - Realizar investigación, desarrollo e innovación en productos, procesos y/o métodos en ingeniería biomédica

CE-MIB05 - Capacidad de diseñar un sistema, componente o proceso de respuesta a necesidades identificadas atendiendo a restricciones realistas considerando desde aspectos económicos y sociales hasta de seguridad o implementabilidad.

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

RA141 - Capacidad de evaluación del diseño para cubrir la necesidad identificada.

RA6 - Proceso creativo de diseño concretándose en la definición de especificaciones e implementación utilizando técnicas de prototipado rápido

RA5 - Escrutinio de soluciones alternativas de ingeniería biomédica, tratando de optimizar el éxito de la solución considerando información multidisciplicar y las restricciones del contexto real del problema

RA4 - Capacidad de identificación de necesidades no cubiertas dentro de procesos y/o protocolos clínicos

* 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

Objectives: This course will focus in the design of real world medical technology development. It will consist of an intensive and practical introduction to understand and define significant unmet medical needs and designing new medical technologies to address them.

Learning outcomes:

- Selecting and characterizing clinical needs

- Validation of clinical needs

- Broad proposal of initial concepts and solutions

- Proof of concept creation - first basic prototypes

4.2. Syllabus

1. Needs finding

    1.1. Strategic Focus

    1.2. Needs Exploration

    1.3. Need Statement Development

2. Needs screening

    2.1. Disease state fundamentals

    2.2. Existing Solutions

    2.3. Stakeholders Analysis

    2.4. Market Analysis

    2.5. Needs selection

3. Concept generation

    3.1. Ideation

    3.2. Initial Concept Selection

4. Concept generation

    4.1. Intellectual property basics

    4.2. Regulatory Basics

    4.3. Reimbusement Basics

    4.4. Business Models

4.5. Concept Exploration and Testing

4.6. Final Concept Selection

5. Schedule

5.1. Subject schedule*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	**Introduction to the subject** Duration: 01:30 Lecture **Team Building Activity** Duration: 00:30 Cooperative activities			**Quizes and progress deliverables** Online test Continuous assessment and final examination Not Presential Duration: 01:00
2	**1.1 Strategic Focus** Duration: 01:00 Lecture **Team Formations, S&W, Acceptance Criteria** Duration: 01:00 Cooperative activities			
3	**1.2 Needs Exploration** Duration: 01:00 Lecture **Health problems discussions, and need exploration planning** Duration: 01:00 Cooperative activities			
4	**1.3 Need Statement** Duration: 01:00 Lecture **Need statement practice** Duration: 01:00 Cooperative activities			
5	**2.1 Disease State Fundamentals 2.2 Existing solutions** Duration: 01:30 Lecture **Disease Fundamentals and Existing solutions practice** Duration: 00:30 Cooperative activities			
6	**2.3 Stakeholder Analysis 2.4 Market Analysis** Duration: 01:00 Lecture **Why, Who, Where analysis of unmet needs** Duration: 01:00 Cooperative activities			

7	**2.5 Needs seletion** Duration: 01:00 Lecture **Needs selection practice in groups** Duration: 01:00 Cooperative activities			
8				**Midterm Report and presentation** Group presentation Continuous assessment and final examination Presential Duration: 02:00
9	**3.1 Ideation** Duration: 01:00 Cooperative activities **Generating ideas Activity** Duration: 01:00 Cooperative activities			
10	**3.2 Initial Concept** Duration: 01:00 Lecture **Working in groups in defining concepts** Duration: 01:00 Cooperative activities			
11	**4.1 Intellectual Property Basics 4.2 Regulatory basics, 4.3 Reimbursement Basics** Duration: 01:30 Lecture **Practicing Clinical workflow and who pays by group** Duration: 00:30 Cooperative activities			
12	**4.4 Business Models 4.5 Concept Exploration and Testing** Duration: 01:00 Lecture **Protype ideation** Duration: 01:00 Cooperative activities			
13	**4.6 Concept Selection** Duration: 01:00 Lecture **Concept selection practice, factors selection** Duration: 01:00 Cooperative activities			
				Final Report and presentation Group presentation Continuous assessment and final examination Presential Duration: 02:00 **Internal Team Evaluation**

14				Other assessment
				Continuous assessment
				Not Presential
				Duration: 00:10
				Individual evaluation
				Other assessment
				Continuous assessment
				Not Presential
				Duration: 00:00
15				**Written Exam**
				Written test
				Final examination
				Presential
				Duration: 01:00
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.

PR/CL/001
COORDINATION PROCESS OF
LEARNING ACTIVITIES

ANX-PR/CL/001-01
LEARNING GUIDE

ETSIT UPM

E.T.S. de Ingenieros de
Telecomunicacion

6. Activities and assessment criteria

6.1. Assessment activities

6.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
1	Quizes and progress deliverables	Online test	No Presential	01:00	10%	3 / 10	CG-MIB04 CG-MIB06 CG-MIB07 CG-MIB01
8	Midterm Report and presentation	Group presentation	Face-to-face	02:00	30%	5 / 10	CB07 CB09 CB08 CB10 CG-MIB03 CG-MIB06 CG-MIB07 CG-MIB02
14	Final Report and presentation	Group presentation	Face-to-face	02:00	40%	5 / 10	CB06 CB07 CB09 CB08 CB10 CG-MIB03 CG-MIB05 CG-MIB06 CG-MIB07 CG-MIB01 CE-MIB04 CE-MIB05
14	Internal Team Evaluation	Other assessment	No Presential	00:10	10%	3 / 10	CB08 CB10 CG-MIB06 CE-MIB05
14	Individual evaluation	Other assessment	No Presential	00:00	10%	3 / 10	CB09 CG-MIB06 CE-MIB05

6.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
1	Quizes and progress deliverables	Online test	No Presential	01:00	10%	3 / 10	CG-MIB04 CG-MIB06 CG-MIB07 CG-MIB01
8	Midterm Report and presentation	Group presentation	Face-to-face	02:00	30%	5 / 10	CB07 CB09 CB08 CB10 CG-MIB03 CG-MIB06 CG-MIB07 CG-MIB02
14	Final Report and presentation	Group presentation	Face-to-face	02:00	40%	5 / 10	CB06 CB07 CB09 CB08 CB10 CG-MIB03 CG-MIB05 CG-MIB06 CG-MIB07 CG-MIB01 CE-MIB04 CE-MIB05
15	Written Exam	Written test	Face-to-face	01:00	20%	5 / 10	CB06 CB07 CB08 CG-MIB06 CE-MIB05

6.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Quizes and progress deliverables	Online test	Face-to-face	01:00	10%	3 / 10	CG-MIB04 CG-MIB06 CG-MIB07 CG-MIB01
Midterm Report and presentation	Group presentation	Face-to-face	02:00	30%	5 / 10	CB07 CB09 CB08 CB10 CG-MIB06 CG-MIB07 CG-MIB01 CG-MIB02

PR/CL/001
COORDINATION PROCESS OF
LEARNING ACTIVITIES

ANX-PR/CL/001-01
LEARNING GUIDE

ETSIT UPM

E.T.S. de Ingenieros de
Telecomunicacion

						CB06
Final Report and presentation	Group presentation	Face-to-face	02:00	40%	5 / 10	CB07 CB09 CB08 CB10 CG-MIB03 CG-MIB05 CG-MIB06 CG-MIB07 CG-MIB01 CE-MIB04 CE-MIB05
Written Exam	Written test	Face-to-face	01:00	20%	5 / 10	CB06 CB07 CB08 CG-MIB06 CE-MIB05

6.2. Assessment criteria

Students will be qualified through progressive evaluation.

Evaluation will assess if students have acquired all the competences of the subject. Thus, evaluation through final assessment will be carried out considering all the evaluation techniques used in continuous evaluation (EX, ET, TG, etc.), and will be celebrated in the exam period approved by Junta de Escuela for the current academic semester and year. Evaluation activities that assess learning outcomes difficult to assess in the final examination could be carried out along the semester.

Extraordinary examination will be carried following the same scheme as the final assessment method.

Progressive Evaluation

- Quizzes and progress deliverables -10%
- Midterm Report - 30%
- Final Written Report and Presentation - 40%
- Team Evaluations -10%
- Individual Performance within the team, preparations, participation and attendance - 10%
- An additional 5% could be added to the mark if the students participate in EIT Health Innovation Days or any other similar health innovation hackathon during the period of the subject.

Final assessment & Extraordinary examination

Quizzes and progress deliverables -10%

Midterm Report - 30%

Final Written Report and Presentation - 40%

Written exam -20%

7. Teaching resources

7.1. Teaching resources for the subject

Name	Type	Notes
Biodesign: The Process of Innovating Medical Technologies (second edition), P. G. Yock, S. Zenios, J. Makower, T. J. Brinton, U. N. Kumar, F. T. J. Watkins, L. Denend, T. M. Krummel, C. Q. Kurihara, Cambridge University Press 2015	Bibliography	Main resource of the subject describing the design methodology
ebiodesign.org	Web resource	Videos, and other resources to guide the students in the application of the design methodology
Espacio Moodle de la asignatura	Web resource	In this website the material covered by the subject will be uploaded as well as the quizzes and deliverables.

PR/CL/001
COORDINATION PROCESS OF
LEARNING ACTIVITIES

ANX-PR/CL/001-01
LEARNING GUIDE

ETSIT
UPM

E.T.S. de Ingenieros de
Telecomunicacion

8. Other information

8.1. Other information about the subject

In case that the authorities requiere that online teaching is required to all the students or part of them, the necessary materials will be provided, including videos, papers, links, etc. and videoconference tools such as Zoom and Teams tools could be used to facilitate the remote teaching and participation.

This course is related to United Nations' Sustainable Development Goals, specially SDG3 (Good health and well-being) but also SDG4 (Quality education), SDG9 (industry, innovation, and infrastructure) and SDG10 (Reduced inequalities)