



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

93000961 - Biomedical Technologies Design

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	93000961 - Biomedical Technologies Design
No of credits	3 ECTS
Type	Compulsory
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 *
Juan Jose Gomez Valverde	C-203	juanjo.gomez@upm.es	Th - 10:00 - 11:00
Andres De Santos Lleo (Subject coordinator)	C-227	andres.santos@upm.es	Sin horario. Appointment by email
Carlos Alberto Lopez Barrio	C-207	c.lbarrio@upm.es	Tu - 18:00 - 19:00

* 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 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

RA100 - Proposal of alternative solution designs to identified unmet clinical needs.

RA101 - Creative teamwork process of iterative design of concepts of solution using iterative prototyping.

RA99 - Identifying and defining unmet clinical needs as part of the clinical care cycle or clinical processes and protocols.

* 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. Reimbursement Basics
 - 4.4. Business Models
 - 4.5. Concept Exploration and Testing
 - 4.6. Final Concept Selection

5. Schedule

5.1. Subject schedule*

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

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

14				<p>Other assessment Continuous assessment Not Presential Duration: 00:10</p> <p>Individual evaluation Other assessment Continuous assessment Not Presential Duration: 00:00</p>
15				<p>Written Exam Written test Final examination Presential Duration: 01:00</p>
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
1	Quizes and progress deliverables	Online test	No Presential	01:00	10%	3 / 10	CG-MIB04 CG-MIB07 CG-MIB01
8	Midterm Report and presentation	Group presentation	Face-to-face	02:00	30%	5 / 10	CG-MIB03 CG-MIB07 CG-MIB02 CB07 CB08 CB09 CB10
14	Final Report and presentation	Group presentation	Face-to-face	02:00	40%	5 / 10	CG-MIB01 CG-MIB03 CG-MIB05 CG-MIB07 CB06 CB07 CB08 CB09 CB10 CE-MIB04 CE-MIB05
14	Internal Team Evaluation	Other assessment	No Presential	00:10	10%	3 / 10	CB10 CB08 CE-MIB05
14	Individual evaluation	Other assessment	No Presential	00:00	10%	3 / 10	CB09 CE-MIB05

6.1.2. Final 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-MIB07 CG-MIB01

8	Midterm Report and presentation	Group presentation	Face-to-face	02:00	30%	5 / 10	CG-MIB03 CG-MIB07 CG-MIB02 CB07 CB08 CB09 CB10
14	Final Report and presentation	Group presentation	Face-to-face	02:00	40%	5 / 10	CG-MIB01 CG-MIB03 CG-MIB05 CG-MIB07 CB06 CB07 CB08 CB09 CB10 CE-MIB04 CE-MIB05
15	Written Exam	Written test	Face-to-face	01:00	20%	5 / 10	CB06 CB08 CE-MIB05 CB07

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	
Midterm Report and presentation	Group presentation	Face-to-face	02:00	30%	5 / 10	CB09 CB10 CB08 CB07
Final Report and presentation	Group presentation	Face-to-face	02:00	40%	5 / 10	CB09 CB10 CB06 CE-MIB04 CB08 CE-MIB05 CB07
Written Exam	Written test	Face-to-face	01:00	20%	5 / 10	CB06 CB08 CE-MIB05 CB07

6.2. Assessment criteria

Students will be qualified through continuous evaluation by default. According to the Normativa de Evaluación del Aprendizaje de la Universidad Politécnica de Madrid, students willing to renounce to continuous evaluation must send an email to the coordinator before the end of week 4

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 (resit) examination will be carried out exclusively by the final assessment method.

Continuous 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 2019 EIT Innovation Days.

Final assessment & resit 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.

8. Other information

8.1. Other information about the subject

In case that the authorities require to continue the course online, the students will be provided with the necessary material, including videos, papers, links, etc. Zoom and Teams tools could be used to facilitate the communication.

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)