



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**

**93000964 - Telemedicine**

**DEGREE PROGRAMME**

09AU - Master Universitario En Ingenieria Biomedica

**ACADEMIC YEAR & SEMESTER**

2023/24 - Semester 1

## Index

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### Learning guide

1. Description.....	1
2. Faculty.....	1
3. Skills and learning outcomes .....	2
4. Brief description of the subject and syllabus.....	4
5. Schedule.....	6
6. Activities and assessment criteria.....	9
7. Teaching resources.....	14
8. Other information.....	15

## 1. Description

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### 1.1. Subject details

<b>Name of the subject</b>	93000964 - Telemedicine
<b>No of credits</b>	3 ECTS
<b>Type</b>	Optional
<b>Academic year of the programme</b>	First year
<b>Semester of tuition</b>	Semester 1
<b>Tuition period</b>	September-January
<b>Tuition languages</b>	English
<b>Degree programme</b>	09AU - Master Universitario en Ingeniería Biomedica
<b>Centre</b>	09 - Escuela Técnica Superior De Ingenieros De Telecomunicacion
<b>Academic year</b>	2023-24

## 2. Faculty

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### 2.1. Faculty members with subject teaching role

<b>Name and surname</b>	<b>Office/Room</b>	<b>Email</b>	<b>Tutoring hours *</b>
Maria Fernanda Cabrera Umpierrez (Subject coordinator)	D-108	mf.cabrera@upm.es	M - 11:00 - 12:00

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

## 2.2. Research assistants

Name and surname	Email	Faculty member in charge
Merino Barbancho, Beatriz	beatriz.merino@upm.es	Cabrera Umpierrez, Maria Fernanda

## 3. Skills and learning outcomes \*

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### 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-MIB10 - Aplicar los métodos de análisis, modelado y tecnologías más actuales para el análisis, diseño, desarrollo y evaluación de sistemas y servicios avanzados de telemedicina.

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**

RA12 - Ser capaz de aplicar los métodos de análisis, modelado y tecnologías más actuales para el análisis, diseño, desarrollo y evaluación de sistemas y servicios avanzados de telemedicina.

\* 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

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### 4.1. Brief description of the subject

The objective of this subject is to provide the student with a comprehensive understanding of the theoretical and practical aspects related to telemedicine. Through this course, students will gain the knowledge and skills required to design, develop, and evaluate telemedicine projects effectively.

The subject aims to familiarize students with the various actors, methodologies, and technologies that play a significant role in the field of telemedicine. Students will explore the different stakeholders involved in telemedicine, such as healthcare professionals, patients, and technology providers. They will gain insights into the roles, responsibilities, and collaborations among these actors to deliver telemedicine services efficiently.

Moreover, the subject will cover a range of methodologies used in telemedicine projects. Students will learn about the process of needs assessment, including identifying the healthcare challenges that telemedicine can address and understanding the specific requirements of target populations. They will also explore the principles of project management, including planning, implementation, and monitoring of telemedicine initiatives.

In addition, the subject will delve into the technologies utilized in telemedicine. Students will study the various communication platforms, software applications, and medical devices commonly employed in telemedicine projects. They will gain an understanding of the technical considerations, such as data security, privacy, and interoperability, that are crucial for the successful implementation of telemedicine solutions.

The practical aspect of the subject will provide students with hands-on experience in telemedicine project development. They will have the opportunity to engage in case studies, simulations, or real-world projects, allowing them to apply their knowledge and skills to solve telemedicine-related challenges. Students will also learn how to evaluate the effectiveness and impact of telemedicine interventions, considering factors like patient outcomes, cost-effectiveness, and user satisfaction.

Overall, by the end of the subject, students will be equipped with the technical know-how and practical insights necessary to design, develop, and evaluate telemedicine projects. They will be prepared to contribute to the advancement of telemedicine and make informed decisions in the dynamic and rapidly evolving field of remote healthcare delivery.

## 4.2. Syllabus

1. Telemedicine
  - 1.1. Introduction
  - 1.2. Personalised health
  - 1.3. eHealth challenges
  - 1.4. Practical case
2. Design and development methodologies
  - 2.1. User requirements methodologies
  - 2.2. Interaction modelling
  - 2.3. Development methodologies
  - 2.4. Interfaces and interaction
  - 2.5. Evaluation methodologies
  - 2.6. Usability evaluation
3. Technologies and architectures
  - 3.1. Technologies
  - 3.2. Architectures
4. Health information management
5. Validation of Health systems
  - 5.1. Clinical trials
  - 5.2. Health technology assessment
6. Healthcare projects deployment
7. Healthcare management models
8. Examples of telemedicine systems

## 5. Schedule

### 5.1. Subject schedule\*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	<p><b>Introduction</b> Duration: 00:30 Lecture</p> <p><b>Lesson 1</b> Duration: 01:00 Lecture</p> <p><b>Debate (workshop)</b> Duration: 00:30 Additional activities</p> <p><b>Lesson 2.1</b> Duration: 01:15 Lecture</p> <p><b>Debate (workshop)</b> Duration: 00:45 Additional activities</p>			
2	<p><b>Lessons 2.2 2.3</b> Duration: 01:15 Lecture</p> <p><b>Debate (workshop)</b> Duration: 00:45 Additional activities</p> <p><b>Lesson 2.4</b> Duration: 01:15 Lecture</p> <p><b>Debate (workshop)</b> Duration: 00:45 Additional activities</p>			<p><b>Attendance and active participation in the debate</b> Other assessment Continuous assessment Presential Duration: 00:00</p>
3	<p><b>Lessons 2.5, 2.6</b> Duration: 01:15 Lecture</p> <p><b>Debate (workshop)</b> Duration: 00:45 Additional activities</p> <p><b>Lesson 3</b> Duration: 01:15 Lecture</p> <p><b>Debate (workshop)</b> Duration: 00:45 Additional activities</p>			<p><b>Attendance and active participation in the debate</b> Other assessment Continuous assessment Presential Duration: 00:00</p> <p><b>Attendance and active participation in the debate</b> Other assessment Continuous assessment Presential Duration: 00:00</p>



4	<p><b>Lesson 4.1</b> Duration: 01:15 Lecture</p> <p><b>Debate (workshop)</b> Duration: 00:45 Additional activities</p> <p><b>Lesson 4.2</b> Duration: 01:15 Lecture</p> <p><b>Debate (workshop)</b> Duration: 00:45 Additional activities</p>			<p><b>Attendance and active participation in the debate</b> Other assessment Continuous assessment Presential Duration: 00:00</p> <p><b>Attendance and active participation in the debate</b> Other assessment Continuous assessment Presential Duration: 00:00</p>
5	<p><b>Lesson 5</b> Duration: 01:15 Lecture</p> <p><b>Debate (workshop)</b> Duration: 00:45 Additional activities</p> <p><b>Lesson 6</b> Duration: 01:15 Lecture</p> <p><b>Debate (workshop)</b> Duration: 00:45 Additional activities</p>			<p><b>Attendance and active participation in the debate</b> Other assessment Continuous assessment Presential Duration: 00:00</p> <p><b>Attendance and active participation in the debate</b> Other assessment Continuous assessment Presential Duration: 00:00</p>
6	<p><b>Lesson 7</b> Duration: 01:15 Lecture</p> <p><b>Debate (workshop)</b> Duration: 00:45 Additional activities</p> <p><b>Lesson 8</b> Duration: 01:15 Lecture</p> <p><b>Debate (workshop)</b> Duration: 00:45 Additional activities</p>			<p><b>Attendance and active participation in the debate</b> Other assessment Continuous assessment Presential Duration: 00:00</p> <p><b>Attendance and active participation in the debate</b> Other assessment Continuous assessment Presential Duration: 00:00</p>
7	<p><b>Lesson 9</b> Duration: 01:15 Lecture</p> <p><b>Debate (workshop)</b> Duration: 00:45 Additional activities</p>			<p><b>Attendance and active participation in the debate</b> Other assessment Continuous assessment Presential Duration: 00:00</p> <p><b>Practical case presentation. Compulsory activity</b> Group presentation Continuous assessment Presential Duration: 02:00</p> <p><b>Practical case presentation. Compulsory activity</b> Group presentation</p>

				Final examination Presential Duration: 01:00
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				<b>Final exam</b> Written test Continuous assessment Presential Duration: 02:00  <b>Final assessment: Exam</b> Written test Final examination 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
2	Attendance and active participation in the debate	Other assessment	Face-to-face	00:00	1%	5 / 10	CB06 CB07 CB09 CB08 CB10 CG-MIB03 CG-MIB04 CG-MIB05 CG-MIB06 CG-MIB07 CG-MIB01 CG-MIB02 CE-MIB10
3	Attendance and active participation in the debate	Other assessment	Face-to-face	00:00	1%	5 / 10	CB06 CB07 CB09 CB08 CB10 CG-MIB03 CG-MIB04 CG-MIB05 CG-MIB06 CG-MIB07 CG-MIB01 CG-MIB02 CE-MIB10
3	Attendance and active participation in the debate	Other assessment	Face-to-face	00:00	1%	5 / 10	CB06 CB07 CB09 CB08 CB10 CG-MIB03 CG-MIB05 CG-MIB06 CG-MIB07 CG-MIB02 CE-MIB10

4	Attendance and active participation in the debate	Other assessment	Face-to-face	00:00	1%	5 / 10	CB06 CB07 CB09 CB08 CB10 CG-MIB03 CG-MIB04 CG-MIB05 CG-MIB06 CG-MIB07 CG-MIB01 CG-MIB02 CE-MIB10
4	Attendance and active participation in the debate	Other assessment	Face-to-face	00:00	1%	5 / 10	CB06 CB07 CB09 CB08 CB10 CG-MIB03 CG-MIB04 CG-MIB05 CG-MIB06 CG-MIB07 CG-MIB01 CG-MIB02 CE-MIB10
5	Attendance and active participation in the debate	Other assessment	Face-to-face	00:00	1%	5 / 10	CB06 CB07 CB09 CB08 CB10 CG-MIB03 CG-MIB04 CG-MIB05 CG-MIB06 CG-MIB07 CG-MIB01 CG-MIB02 CE-MIB10
5	Attendance and active participation in the debate	Other assessment	Face-to-face	00:00	1%	5 / 10	CB06 CB07 CB09 CB08 CB10 CG-MIB03 CG-MIB04 CG-MIB05 CG-MIB06 CG-MIB07 CG-MIB01 CG-MIB02 CE-MIB10

6	Attendance and active participation in the debate	Other assessment	Face-to-face	00:00	1%	5 / 10	CB06 CB07 CB09 CB08 CB10 CG-MIB03 CG-MIB05 CG-MIB06 CG-MIB07 CG-MIB02 CE-MIB10
6	Attendance and active participation in the debate	Other assessment	Face-to-face	00:00	1%	5 / 10	CB06 CB07 CB09 CB08 CB10 CG-MIB03 CG-MIB04 CG-MIB05 CG-MIB06 CG-MIB07 CG-MIB01 CG-MIB02 CE-MIB10
7	Attendance and active participation in the debate	Other assessment	Face-to-face	00:00	1%	5 / 10	CB06 CB07 CB09 CB08 CB10 CG-MIB03 CG-MIB04 CG-MIB05 CG-MIB06 CG-MIB07 CG-MIB01 CG-MIB02 CE-MIB10
7	Practical case presentation. Compulsory activity	Group presentation	Face-to-face	02:00	50%	5 / 10	CB07 CB09 CB08
17	Final exam	Written test	Face-to-face	02:00	40%	5 / 10	CB06 CB07 CB10 CG-MIB03 CG-MIB04 CG-MIB05 CG-MIB06 CG-MIB07 CG-MIB02 CE-MIB10

### 6.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
7	Practical case presentation. Compulsory activity	Group presentation	Face-to-face	01:00	50%	5 / 10	CB07 CB09 CB08
17	Final assessment: Exam	Written test	Face-to-face	02:00	40%	5 / 10	CB06 CB07 CB10 CG-MIB03 CG-MIB04 CG-MIB05 CG-MIB06 CG-MIB07 CG-MIB01 CG-MIB02 CE-MIB10

### 6.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Written exam	Written test	Face-to-face	02:30	50%	5 / 10	CB06 CB07 CB10 CG-MIB03 CG-MIB04 CG-MIB05 CG-MIB06 CG-MIB07 CG-MIB01 CG-MIB02 CE-MIB10
Practical case presentation. Compulsory activity	Other assessment	Face-to-face	02:30	50%	5 / 10	CB07 CB09 CB08

## 6.2. Assessment criteria

The course will be approved when a grade greater than or equal to 5 points out of a total of 10 is obtained.

### Progressive evaluation

By default, students will be evaluated through progressive evaluation. The final grade in progressive evaluation will be determined by summing the qualifications corresponding to the different evaluation activities, with the following weights:

- Written exam: 40%
- Completion and presentation of mandatory group work: 50%
- Attendance and participation: 10%

The evaluation will assess whether students have acquired the competences of the subject. To pass the course, students must obtain a minimum score of 5 out of 10 in the completion of the group work and its presentation, as well as in the written exam. The individual contribution to group work will be supervised and considered a requirement to pass the course.

### Global evaluation

Students who wish to waive the progressive evaluation must send an email through the subject's Moodle platform to the subject coordinator, at least two weeks before the extraordinary exam period approved by the School Board for the current course and semester. In this case, it is necessary to complete the group work and its presentation to acquire all the subject skills, in addition to taking the final exam. The maximum mark that can be obtained in the overall evaluation is 90%. The global evaluation will be carried out considering the evaluation techniques used in the progressive evaluation.

### Extraordinary evaluation

The extraordinary evaluation will follow the same evaluation techniques as the global evaluation.

## 7. Teaching resources

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### 7.1. Teaching resources for the subject

Name	Type	Notes
Documentation with the material provided during the lectures.	Others	<a href="https://moodle.upm.es/titulaciones/oficiales/course/view.php?id=2984">https://moodle.upm.es/titulaciones/oficiales/course/view.php?id=2984</a>
M. Maheu. E-health, telehealth, and telemedicine: a guide to start-up and success. 2001.	Bibliography	
R. Wootton. Introduction to telemedicine (2nd ed). 2006	Bibliography	
T. Weilkens. Systems engineering with SysML/UML: modeling, analysis, design. 2006	Web resource	
Joseph C. Kvedar MD, MB, Carol Colman, Gina Cella (2015) The Internet of Healthy Things. Ed. Partners Connected Health	Bibliography	
Mobile Health A Technology Road Map. Adibi, Sasan (Ed.) 2015	Bibliography	
Pieter Cullis. The Personalized Medicine Revolution: How Diagnosing and Treating Disease Are About to Change Forever. 2015	Bibliography	



## 8. Other information

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### 8.1. Other information about the subject

This course is designed to empower students and cultivate them as active global citizens who can drive sustainable development through innovation. Aligned with several Sustainable Development Goals (SDGs), the course aims to nurture students into innovative engineers and leaders capable of finding new solutions to address today's and tomorrow's challenges. In particular, it emphasizes the importance of SDG 3, which advocates for ensuring a healthy life and promoting well-being for all.

Through this subject, students will expand their creativity skills and learn to design sustainable solutions that consider technical, functional, and socioeconomic aspects. They will develop teamwork, planning, organization, and communication skills. Moreover, they will acquire the ability to identify, formulate, and solve engineering problems while evaluating their societal impact. Ethical and privacy considerations will also be emphasized throughout the course.

The objectives of this subject align with the sub-goals outlined in SDG 4.3, which emphasizes access to quality technical and higher education; SDG 4.4, which aims to increase the number of individuals with the necessary technical skills for employment and entrepreneurship; and SDG 4.7, which highlights the importance of theoretical and practical knowledge for promoting sustainable development.

By offering new learning opportunities and skills, this course empowers students to contribute to these sub-goals. The course emphasizes the digital transformation of health, which plays a crucial role in enhancing the efficiency and sustainability of current healthcare systems. Additionally, it paves the way for significant advancements in the health and well-being of patients and citizens as a whole.