



POLITÉCNICA

INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

COORDINATION PROCESS OF  
LEARNING ACTIVITIES  
PR/CL/001



E.T.S. de Ingenieros de  
Telecomunicación

# ANX-PR/CL/001-01

## LEARNING GUIDE

**SUBJECT**

**93000966 - Bioinstrumentation**

**DEGREE PROGRAMME**

09AU - Master Universitario en Ingeniería Biomedica

**ACADEMIC YEAR & SEMESTER**

2020/21 - Semester 1

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## 1. Description

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### 1.1. Subject details

<b>Name of the subject</b>	93000966 - Bioinstrumentation
<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 Tecnica Superior de Ingenieros de Telecomunicacion
<b>Academic year</b>	2020-21

## 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>
Jose Javier Serrano Olmedo (Subject coordinator)	L307 Edificio A	josejavier.serrano@upm.es	Tu - 13:00 - 15:00

\* 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 \*

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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-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

RA70 - Identify the main biomedical signals by nature and/or the absence/presence of anomalies

RA63 - Accomplish individual and team works by searching different sources of information and critical discussion as well as presenting the results in oral presentation

RA80 - EN\_RA11 - Presenting the project in written, oral and public form

RA65 - Enumerate the main devices used for the acquisition and processing of biomedical signals

RA89 - Identify and know how to use today methods and techniques involving sensors and the measurement for the acquisition of biologic parameters and signals most relevant in biomedicine, with especial emphasis on emerging sensors and their background technologies for the analysis and design of advanced diagnostic and therapy systems, including continuous patient monitoringde pacientes.

\* 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

1. Introduction: bioinstrumentation nowadays and trends.
2. Advance techniques in bioelectric instrumentation design.
3. Advance techniques in biophysical instrumentation design.
4. Advance techniques in biochemical instrumentation design.

## 4.2. Syllabus

1. Bioelectric Instrumentation
2. Biophysical instrumentation
3. Biochemical instrumentation

## 5. Schedule

### 5.1. Subject schedule\*

Week	Face-to-face classroom activities	Face-to-face laboratory activities	Distant / On-line	Assessment activities
1	<b>Introduction</b> Duration: 03:45 Lecture			<b>Short questions at the end of the week</b> Written test Continuous assessment Presential Duration: 00:15
2	<b>Subjet 1</b> Duration: 03:45 Lecture			<b>Short questions at the end of the week</b> Written test Continuous assessment Presential Duration: 00:15
3	<b>Subjet 1</b> Duration: 03:45 Lecture			<b>Short questions at the end of the week</b> Written test Continuous assessment Presential Duration: 00:15
4	<b>Subjet 1</b> Duration: 03:45 Lecture			<b>Short questions at the end of the week</b> Written test Continuous assessment Presential Duration: 00:15
5	<b>Subjet 1</b> Duration: 03:45 Lecture			<b>Short questions at the end of the week</b> Written test Continuous assessment Presential Duration: 00:15
6	<b>Subjet 1</b> Duration: 03:45 Lecture			<b>Short questions at the end of the week</b> Written test Continuous assessment Presential Duration: 00:15
7	<b>Subjet 2</b> Duration: 02:00 Lecture			<b>Written works presentations</b> Individual presentation Continuous assessment Presential Duration: 02:00
8				<b>Written exam</b> Written test Continuous assessment Presential Duration: 01:00  <b>Written works presentations</b> Individual presentation Final examination Presential Duration: 00:20  <b>Written exam</b> Written test

				Final examination Presential Duration: 01:00
9				
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
1	Short questions at the end of the week	Written test	Face-to-face	00:15	5.5%	0 / 10	CG-MIB03 CG-MIB04 CG-MIB05 CG-MIB07 CG-MIB01 CG-MIB02 CE-MIB07
2	Short questions at the end of the week	Written test	Face-to-face	00:15	5.5%	0 / 10	CG-MIB03 CG-MIB04 CG-MIB05 CG-MIB07 CG-MIB01 CG-MIB02 CE-MIB07
3	Short questions at the end of the week	Written test	Face-to-face	00:15	5.5%	0 / 10	CG-MIB03 CG-MIB04 CG-MIB05 CG-MIB07 CG-MIB01 CG-MIB02 CE-MIB07
4	Short questions at the end of the week	Written test	Face-to-face	00:15	5.5%	0 / 10	CG-MIB03 CG-MIB04 CG-MIB05 CG-MIB07 CG-MIB01 CG-MIB02 CE-MIB07
5	Short questions at the end of the week	Written test	Face-to-face	00:15	5.5%	0 / 10	CG-MIB03 CG-MIB04 CG-MIB05 CG-MIB07 CG-MIB01 CG-MIB02 CE-MIB07

6	Short questions at the end of the week	Written test	Face-to-face	00:15	5.5%	0 / 10	CG-MIB03 CG-MIB04 CG-MIB05 CG-MIB07 CG-MIB01 CG-MIB02 CE-MIB07
7	Written works presentations	Individual presentation	Face-to-face	02:00	33%	3 / 10	CG-MIB03 CG-MIB04 CG-MIB05 CG-MIB06 CG-MIB07 CG-MIB01 CG-MIB02 CB06 CB07 CB08 CB09 CB10 CE-MIB07
8	Written exam	Written test	Face-to-face	01:00	34%	3 / 10	CG-MIB03 CG-MIB04 CG-MIB05 CG-MIB07 CG-MIB01 CG-MIB02 CE-MIB07

### 6.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
8	Written exam	Written test	Face-to-face	01:00	67%	3 / 10	CG-MIB04 CG-MIB05 CG-MIB07 CG-MIB01 CG-MIB02 CE-MIB07
8	Written works presentations	Individual presentation	Face-to-face	00:20	33%	3 / 10	CG-MIB03 CG-MIB04 CG-MIB05 CG-MIB06 CG-MIB07 CG-MIB01 CG-MIB02 CB06 CB07 CB08 CB09 CB10 CE-MIB07

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

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Written exam	Written test	Face-to-face	01:00	67%	3 / 10	CG-MIB04 CG-MIB05 CG-MIB07 CG-MIB01 CG-MIB02 CE-MIB07
Written works presentation	Individual presentation	Face-to-face	00:20	33%	3 / 10	CG-MIB03 CG-MIB04 CG-MIB05 CG-MIB06 CG-MIB07 CG-MIB01 CG-MIB02 CB06 CB07 CB08 CB09 CB10 CE-MIB07

## 6.2. Assessment criteria

In written work presentations it is assessed the following: medical problem to be solved, background; enabling technologies, several solutions comparison; targeted needs; applications cases, conclusion; used references; clarity of the presentation, summary quality; shown understanding of the field.

In written exams: there are mostly small questions for brief, concise answers, some numerical questions.

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 communicate it using a written solicitude addressed to the coordinator by means of the REGISTRO (in the administrative department) between the second and the fourth (inclusive) weeks of the course.

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 that cannot be evaluated through a single exam can be carried out along the semester.

Extraordinary examination will be carried out exclusively by the final examination method.

## 7. Teaching resources

### 7.1. Teaching resources for the subject

Name	Type	Notes
The Biomedical Engineering Handbook,	Bibliography	Bronzino, J.D. CRC Press
Biopac	Equipment	Instrumentation for acquiring biomedical signals:   ECG, EEG, Pulsioximetry, etc  Through a series of lessons the students make practices 

		with real bioinstruments 
Data acquisition cards and LabVIEW	Equipment	Using Analog to digital converters and the instrumentation  development platform LabVIEW, the students design and   build virtual instruments, particularly an ECG

## 8. Other information

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### 8.1. Other information about the subject

The course is related to the Sustainable Development Goals of the 2030 agenda as follows:

SDG3 on health and well-being for everyone at all ages. Although as a technical subject it does not directly influence any of the sub-objectives, indirectly, training in instruments that help diagnose diseases contributes to improving health.

SDG4 on quality education, in particular 4.4, giving quality training to increase the number of people who acquire professional skills to access quality jobs.