



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

93000966 - Bioinstrumentation

DEGREE PROGRAMME

09AU - Master Universitario En Ingenieria Biomedica

ACADEMIC YEAR & SEMESTER

2023/24 - Semester 1

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1. Description

1.1. Subject details

Name of the subject	93000966 - Bioinstrumentation
No of credits	3 ECTS
Type	Optional
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	2023-24

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Jose Javier Serrano Olmedo (Subject coordinator)	L307 Edificio A	josejavier.serrano@upm.es	Tu - 13:00 - 15:00
Cecilia Vera Muñoz	D204	cecilia.vera@upm.es	Sin horario. Concertar cita por correo electrónico

* 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-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 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

RA16 - Ser capaz de identificar y utilizar los métodos y técnicas actuales en sensores y medida para la adquisición de variables y señales biológicas de mayor relevancia en biomedicina, con hincapié especial en los sensores emergentes y en las tecnologías en que se basan, para el análisis y diseño de sistemas avanzados de diagnóstico, terapia y monitorización de 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

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	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	Introduction Duration: 03:45 Lecture			Short questions at the end of the week Written test Continuous assessment Presential Duration: 00:15
2	Bioelectric Instrumentation Duration: 03:45 Lecture			Short questions at the end of the week Written test Continuous assessment Presential Duration: 00:15
3	Bioelectric Instrumentation Duration: 03:45 Lecture			Short questions at the end of the week Written test Continuous assessment Presential Duration: 00:15
4	Bioelectric Instrumentation Duration: 03:45 Lecture			Short questions at the end of the week Written test Continuous assessment Presential Duration: 00:15
5	Biophysical Instrumentation Duration: 03:45 Lecture			Short questions at the end of the week Written test Continuous assessment Presential Duration: 00:15
6	Biophysical Instrumentation Duration: 03:45 Lecture			Short questions at the end of the week Written test Continuous assessment Presential Duration: 00:15
7	Biochemical Instrumentation Duration: 02:00 Lecture			Written works presentations Individual presentation Continuous assessment Presential Duration: 02:00
8				Written exam Written test Continuous assessment Presential Duration: 01:00 Written works presentations Individual presentation Final examination Presential Duration: 00:20 Written exam 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. 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%	0 / 10	CB06 CB07 CB09 CB08 CB10 CG-MIB03 CG-MIB04 CG-MIB05 CG-MIB06 CG-MIB07 CG-MIB01 CG-MIB02 CE-MIB07
8	Written exam	Written test	Face-to-face	01:00	34%	0 / 10	CG-MIB03 CG-MIB04 CG-MIB05 CG-MIB07 CG-MIB01 CG-MIB02 CE-MIB07

6.1.2. Global 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	CB06 CB07 CB09 CB08 CB10 CG-MIB03 CG-MIB04 CG-MIB05 CG-MIB06 CG-MIB07 CG-MIB01 CG-MIB02 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	CB06 CB07 CB09 CB08 CB10 CG-MIB03 CG-MIB04 CG-MIB05 CG-MIB06 CG-MIB07 CG-MIB01 CG-MIB02 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, plus some numerical questions.

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.

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

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.