



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

93000985 - Bioinstrumentation Laboratory

DEGREE PROGRAMME

09AU - Master Universitario En Ingenieria Biomedica

ACADEMIC YEAR & SEMESTER

2023/24 - Semester 2

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1. Description

1.1. Subject details

Name of the subject	93000985 - Bioinstrumentation Laboratory
No of credits	3 ECTS
Type	Optional
Academic year of the programme	First year
Semester of tuition	Semester 2
Tuition period	February-June
Tuition languages	English
Degree programme	09AU - Master Universitario en Ingeniería 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)	A-L307	josejavier.serrano@upm.es	Th - 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

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

RA34 - Aplicar los principios y aplicaciones de los campos bioeléctricos, desde una descripción de los aspectos básicos de los tejidos excitables causantes de la actividad bioelectromagnética y de su fundamento teórico y formalización matemática. Derivación de los fenómenos bioelectromagnéticos para el análisis e interpretación de las variables medidas. Estudiar las aplicaciones clínicas de los campos electromagnéticos

* 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

Goals:

To acquire personal experience on the procedures for the measurement of biomedical signals, the inherent difficulties of the problem and some techniques to minimize them.

Methodology:

It is mainly a group laboratory work, with a theoretical introduction to the sensors that are used, the most necessary elements of electronics, and the signal capture software available. The work outside the laboratory should be reduced to the preparation of the practice reports. The practices are carried out in a guided way through the concatenation of tasks whose result is very concrete and independent of the other tasks. Issues are raised in writing as the tasks progress, the response of which must be included as an essential part of the reports. Thus, instead of proposing the final result to be obtained from the beginning, partial results are proposed, whose sequential achievement leads to the expected final result.

Documentation:

Script of practices and transparencies corresponding to the presentation of the laboratory.

Bibliography:

- M. Lambrechts y W. Sansen. *Biosensors: Microelectrochemical Devices*. IOP Publishing Ltd. 1992.
- L. Cromwell, F. J. Wibell y E. A. Pfeiffer. *Biomedical Instrumentation and Measurements*. Prentice Hall 1980.
- John G. Webster, *Medical Instrumentation: Application and Design*. John Wiley & Sons 1997
- J. D. Bronzino. *Biomedical Engineering Handbook*, CRC Press & IEEE Press 2000.
- H.J. Arditty, J.P. Dakin and R. Th Kersten. *Optical Fiber Sensors*. Springer Verlag 1989.

- IEEE transactions on biomedical engineering
- Annual International Conference of the IEEE Engineering in Medicine and Biology Society,
- Biosensors and Bioelectronics
- Journal of Biomechanics,

- IEEE Engineering in Medicine and Biology,
- Medical Engineering & Physics

4.2. Syllabus

1. Laboratory presentation.
2. Practices using Biopac
3. Signal capture using PC and LabVIEW: development of a virtual electrocardiographer

5. Schedule

5.1. Subject schedule*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	Practices presentation Duration: 03:00 Lecture			
2	Introduction to the virtual instrumentation Duration: 03:00 Lecture			
3		Introduction to the LabVIEW development system and to BIOPAC Duration: 03:00 Laboratory assignments		
4		Introducing practice to LabVIEW: digitalization of continuous signals and interpretation of results Duration: 03:00 Laboratory assignments		
5		Practice using Biopac Duration: 03:00 Laboratory assignments		
6		Practice using Biopac Duration: 03:00 Laboratory assignments		
7		Practice using Biopac Duration: 03:00 Laboratory assignments		
8		Practice using Biopac Duration: 03:00 Laboratory assignments		
9		Virtual electrocardiographer Duration: 03:00 Laboratory assignments		
10		Virtual electrocardiographer Duration: 03:00 Laboratory assignments		
11		Virtual electrocardiographer Duration: 03:00 Laboratory assignments		
12				Practice supervision Problem-solving test Continuous assessment and final examination Presential Duration: 03:00

13				
14				
15				
16				
17				Exam on the theory Written test Continuous assessment and 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
12	Practice supervision	Problem-solving test	Face-to-face	03:00	80%	0 / 10	CB06 CB07 CG-MIB05 CG-MIB06 CG-MIB07
17	Exam on the theory	Written test	Face-to-face	02:00	20%	0 / 10	CB07 CG-MIB05 CG-MIB06 CG-MIB07

6.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
12	Practice supervision	Problem-solving test	Face-to-face	03:00	80%	0 / 10	CB06 CB07 CG-MIB05 CG-MIB06 CG-MIB07
17	Exam on the theory	Written test	Face-to-face	02:00	20%	0 / 10	CB07 CG-MIB05 CG-MIB06 CG-MIB07

6.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Practice supervision	Problem-solving test	Face-to-face	03:00	80%	0 / 10	CB07 CG-MIB05 CG-MIB06 CG-MIB07

Exam on the theory	Written test	Face-to-face	02:00	20%	0 / 10	CB07 CG-MIB05 CG-MIB06 CG-MIB07
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6.2. Assessment criteria

- Individual exam (20%): Short questions about
 - virtual instrumentation
 - the systems used along the practices
 - the development of the practices.
- Practices evaluation (80%):
 - degree of acquired knowledge on the used equipment and systems
 - degree of achievement of the practices specifications
 - Novelty, if any, over the required specifications

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.

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7. Teaching resources

7.1. Teaching resources for the subject

Name	Type	Notes
BIOPAC	Equipment	Academic system for the capture and treatment of physiological signals.
LabVIEW	Equipment	Development system for virtual instrumentation
Digitizer cards	Equipment	
Electrodes and other consumable materials	Equipment	

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.