# ANX-PR/CL/001-01

# LEARNING GUIDE

## SUBJECT

**93000985 - Bioinstrumentation Laboratory**

## DEGREE PROGRAMME

09AU - Master Universitario En Ingenieria Biomedica

## ACADEMIC YEAR & SEMESTER

2022/23 - Semester 2

# Index

## Learning guide

# 1. Description

## 1.1. Subject details

| | |
|---|---|
| **Name of the subject** | 93000985 - Bioinstrumentation Laboratory |
| **No of credits** | 3 ECTS |
| **Type** | Optional |
| **Academic year ot the programme** | First year |
| **Semester of tuition** | Semester 2 |
| **Tuition period** | February-June |
| **Tuition languages** | English |
| **Degree programme** | 09AU - Master Universitario en Ingenieria Biomedica |
| **Centre** | 09 - Escuela Tecnica Superior De Ingenieros De Telecomunicacion |
| **Academic year** | 2022-23 |

# 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 |

* 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 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

RA129 - to be able to acquire and to interpret biomedical signals using bioinstruments and biosensors

RA130 - To be able to program measurement systems for the adquisition of biomedical signals

* 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**<br>Duration: 03:00<br>Lecture | | | |
| 2 | **Introduction to the virtual instrumentation**<br>Duration: 03:00<br>Lecture | | | |
| 3 | | **Introduction to the LabVIEW development system and to BIOPAC**<br>Duration: 03:00<br>Laboratory assignments | | |
| 4 | | **Introducing practice to LabVIEW: digitalization of continous signlas and interpretationof results**<br>Duration: 03:00<br>Laboratory assignments | | |
| 5 | | **Practice using Biopac**<br>Duration: 03:00<br>Laboratory assignments | | |
| 6 | | **Practice using Biopac**<br>Duration: 03:00<br>Laboratory assignments | | |
| 7 | | **Practice using Biopac**<br>Duration: 03:00<br>Laboratory assignments | | |
| 8 | | **Practice using Biopac**<br>Duration: 03:00<br>Laboratory assignments | | |
| 9 | | **Virtual electrocardiographer**<br>Duration: 03:00<br>Laboratory assignments | | |
| 10 | | **Virtual electrocardiographer**<br>Duration: 03:00<br>Laboratory assignments | | |
| 11 | | **Virtual electrocardiographer**<br>Duration: 03:00<br>Laboratory assignments | | |
| 12 | | | | **Practice supervision**<br>Problem-solving test<br>Continuous assessment and final examination<br>Presential<br>Duration: 03:00 |

| | | | | |
|---|---|---|---|---|
| 13 | | | | |
| 14 | | | | |
| 15 | | | | |
| 16 | | | | |
| 17 | | | | **Exam on the theory**<br>Written test<br>Continuous assessment and final examination<br>Presential<br>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 | CG-MIB05<br>CG-MIB06<br>CG-MIB07<br>CB06<br>CB07 |
| 17 | Exam on the theory | Written test | Face-to-face | 02:00 | 20% | 0 / 10 | CG-MIB05<br>CG-MIB06<br>CG-MIB07<br>CB06<br>CB07 |

### 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 | CG-MIB05<br>CG-MIB06<br>CG-MIB07<br>CB06<br>CB07 |
| 17 | Exam on the theory | Written test | Face-to-face | 02:00 | 20% | 0 / 10 | CG-MIB05<br>CG-MIB06<br>CG-MIB07<br>CB06<br>CB07 |

### 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 | CG-MIB05<br>CG-MIB06<br>CG-MIB07<br>CB06<br>CB07 |
| Exam on the theory | Written test | Face-to-face | 02:00 | 20% | 0 / 10 | CG-MIB05<br>CG-MIB06<br>CG-MIB07<br>CB06<br>CB07 |

## 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 acquered knowledge on the used equipment and systems
  - degree of achievement of the practices specifications
  - Novelty, if any, over the required specifications

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 issue a solicitude through the ETSIT Secretary to the coordinator before the end of third week of beginning of the semester.
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.