

## 69727 - Bioelectricity and electrophysiology

### Syllabus Information

**Academic year:** 2023/24

**Subject:** 69727 - Bioelectricity and electrophysiology

**Faculty / School:** 110 - Escuela de Ingeniería y Arquitectura

**Degree:** 633 - Master's Degree in Biomedical Engineering

**ECTS:** 3.0

**Year:** 1

**Semester:** Second semester

**Subject type:** Optional

**Module:**

### 1. General information

The main objective of this subject is to introduce the student to the principles of bioelectricity related to cardiac electrophysiology, emphasizing not only the physical principles but also the associated numerical aspects. It will provide the student with the basic tools to carry out research work in the numerical simulation of cardiac electrophysiology.

These approaches and objectives are aligned with the Sustainable Development Goals (SDGs) of the United Nations 2030 Agenda (<https://www.un.org/sustainabledevelopment/es/>). Specifically, they will contribute to Objective 3.d of Goal 3, Objectives 9.5 and 9.c of Goal 9, and Objective N2.e of Goal N2.

### 2. Learning results

- To know the principles of cardiac electrophysiology.
- To understand the bioelectrical models of cell membrane and ion channels.
- To understand cardiac cell action potential models.
- To analyse the methods of numerical resolution of the bioelectricity equations.
- To understand the synergy between the different scales present in the cardiac electrophysiology problem.

### 3. Syllabus

Topic 1. Electrophysiology of cardiac cells

Topic 2. Physical principles of electrocardiography

Topic 3. Bioelectrical models of cell membrane and ion channels

Topic 4. Action potential models

Topic 5. Models of action potential propagation in tissues

Topic 6. Numerical solution of action potential propagation and resolution of the extracellular potential.

### 4. Academic activities

**Participative master classes:** 22 hours.

Theoretical-practical sessions in which the contents of the subject will be explained.

**Laboratory practices:** 4 hours.

Practical sessions where simulation and data processing tools will be used to approach the study of cardiac electrophysiology. The student will deliver a script at the end of the sessions.

**Practical application or research work:** 10 hours.

Individual work consisting of solving a simulation problem in electrophysiology.

**Teaching assignments:** 4 hours.

Individual presentation and discussion of a topic.

**Study of the subject, class preparation, practical activities and personal work:** 40 hours.

**Assessment tests:** 6 hours.

### 5. Assessment system

The student is entitled to a global test covering the whole subject in the first call. In the second call, the evaluation will be carried out by means of a global test.

In the first call, the student will be able to opt for:

1) **Mixed system**, which is composed of:

a) Final written test consisting of theoretical-practical questions.

The solution presented in this final written test will be evaluated. It constitutes 50% of the final grade. The student must obtain a minimum total grade of 4 out of 10 points.

b) Tutored practical work.

The report submitted as well as the suitability and originality of the proposed solution will be assessed. These tutored assignments constitute 30% of the final grade. The student must obtain a minimum total grade of 4 out of 10 points.

c) Laboratory practices.

The reports presented in the practical sessions as well as the work done in the laboratory will be evaluated. These laboratory practices constitute 20% of the final grade. The student must obtain a minimum total grade of 4 out of 10 points.

To pass the subject, the student must achieve a minimum grade of 5 points out of 10 points as a result of the weighted average of the three aspects evaluated in the mixed system.

2) **Simple system**, based on the completion of the final written test described above for students who opt for the mixed system.

To pass the subject the student must achieve a minimum grade of 5 out of 10 points in this final written test if they opt for the simple system.