

**COURSE DATA****DATA SUBJECT**

Code: 44778
Name: Bioelectricity
Cycle: Master's Degree
ECTS Credits: 3
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
2231 - Master's Degree in Biomedical Engineering	Facultat de Medicina i Odontologia	1	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
2231 - Master's Degree in Biomedical Engineering	Bridging courses	ELECTIVES

COORDINATION

RAMOS SOLER DAVID

SUMMARY

La información está en un formato que no se puede convertir

PREVIOUS KNOWLEDGE**RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE**

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

It is advisable (but not essential) that the students enrolled in the subject have previous knowledge of the following (or similar) subjects:

* Biophysics: protein structure (primary, secondary and tertiary structure, alpha helices and beta folds) *
Physics: field theory (concept of conservative field and gradient, divergence and rotational operators) *
Morphology at the cellular level: structure of the muscle and nerve cells, structure of the cell membrane, generic concept of action potential and extracel

COMPETENCES / LEARNING OUTCOMES



DESCRIPTION OF CONTENTS

1. Introduction to Bioelectricity

Bioelectricity: introduction, fundamentals and multiscale nature.

2. Ionic currents

Electrical conduction through the cell membrane. Electrical model of the excitable cell. Mathematical model of an ion channel.

3. Action potentials

Bioelectric foundations of action potentials. Action potentials in the nervous system. Action potentials in skeletal muscle. Action potentials in the heart.

4. Bioelectric propagation

Action potential propagation in nervous fibers. Action potential propagation in the myocardium. Bioelectric foundations of cardiac arrhythmias.

5. Extracellular potentials

Extracellular potentials generated by the nervous system (EEG). Extracellular potentials generated by the muscle (EMG). Extracellular potentials generated by the heart (EKG).

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	30,00
Total hours	30,00

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	12,00
Independent study and work	25,00
Preparation of lessons	1,00



Preparation for assessment activities	5,00
Resolution of case studies	2,00
Total hours	45,00

TEACHING METHODOLOGY

In the theory classes, dynamic power point presentations will be used to help understand the theoretical concepts. Students will have this material available in static (pdf) and dynamic (flash) format. The blackboard will be used only for demonstrations and clarifications. In the practical classes, the students shall address a theoretical problem related to bioelectricity and use computer simulation to solve it.

EVALUATION

The mark will be the result of three evaluation acts:

- 1.- A multiple choice test-type exam (value of 80% of the final mark)
- 2.- A report corresponding to a practical session related to single cell bioelectricity (value of 10% of the final mark)
- 3.- A report corresponding to a practical session related to extracellular bioelectricity (value of 10% of the final mark)

REFERENCES

- Referencia b1: Bioelectricity (Robert Plonsey) Referencia b2: Bioelectrónica : señales bioeléctricas (José María Ferrero Corral) Referencia b3: Bioelectromagnetism: Principles and Applications of Bioelectric and Biomagnetic Fields (J. Malmivuo and R. Plonsey)