Universidad Zaragoza

Academic Year/course: 2022/23

69727 - Bioelectricity and electrophysiology

Syllabus Information

Academic Year: 2022/23
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

2. Learning goals

3. Assessment (1st and 2nd call)

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The methodology followed in this course is oriented towards achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as lectures, computer lab sessions, assignments, tutorials, and assessment.

4.2. Learning tasks

The course includes the following learning tasks:

- A01 Lectures (22 hours). The teacher explains the main contents of the course with the support of PowerPoint slides and illustrative examples. The main source of information is the work by Prof. Roger G. Mark, 2004 Principles Of Cardiac Electrophysiology. Massachusetts Institute Of Technology Departments of Electrical Engineering, Mechanical Engineering, and the Harvard-MIT Division of Health Sciences and Technology as a reference (topics 1-2). This activity take place in the classroom. Additionally, there will be a seminar given by an invited expert on the topic.

- A03 Computer lab sessions (6 hours). Activities developed in rooms with computing equipment (computer science rooms). For each 2-hour session, the students will prepare the concepts previously studied in class and will write a report with the main results and conclusions of the session. The third session will be used to finish the work done in the previous sessions. These sessions will be evaluated according to the submitted reports. The obtained score will correspond to 20% of the final score. Each session will deal with:

1) presentation of the software (OpenCOR and Matlab) by the teacher.
2) individual work of the students in their personal computers or in the computer science room.

- A05 Assignments. An individual assignment consisting of the solving of an electrophysiological simulation problem. Each student will present a report with the main results and conclusions. Evaluation will be performed according to E2 evaluation point of this guide.

- A06 Tutorials. Sessions agreed with the students with the objective of reviewing and discussing the materials and topics studied during the course, both theoretical and practical.

- A08 Assessment. A set of theoretical and practical tests and reports used in the evaluation of the student's progress. Further explanation about the evaluation is given in the Assessment section.

4.3. Syllabus

The course will address the following topics:

1. Cardiac cell electrophysiology
2. Physical principles of electrophysiology
3. Bioelectric models of the cellular membrane and ionic channels
4. Action potential modelling
5. Action potential propagation, tissue models
6. Numerical solution of action potential propagation
7. Solution for the extracellular potential. Solution for the torso

4.4. Course planning and calendar

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the EINA website.

4.5. Bibliography and recommended resources

Bibliografía:

- Ferrero Corral, José María. Bioelectrónica General (I) : señales bioeléctricas / José María Ferrero Corral : Universidad Politécnica de Madrid, Escuela técnica superior de Ingenieros industriales, cátedra de electrónica, sección de publicaciones, 1981
- Gulrajani, Ramesh M. Bioelectricity and Biomagnetism / Ramesh M. Gulrajani. New York ; Chichester : John Wiley Sons, 1998
- Malmivuo, Jaakko. Bioelectromagnetism: Principles and Applications of Bioelectric and Biomagnetic Fields / Malmivuo, Jaakko; Plonsey, Robert. Oxford University Press 1995
- Mark, Roger G. Principles of Cardiac electrophysiology / Roger G. Mark. Massachusetts : Institute Of Technology Departments of Electrical Engineering, Mechanical Engineering, and the Harvard-MIT Division of Health Sciences and Technology, 2004

Listado de URLs:

- Malmivuo, Jaakko; Plonsey, Robert. Bioelectromagnetism: Principles and Applications of Bioelectric and Biomagnetic Fields. Oxford University Press 1995. [http://www.bem.fi/book/]