60938 - Biomedical signal processing

Información del Plan Docente

Academic Year	2016/17
Academic center	110 - Escuela de Ingeniería y Arquitectura
Degree	533 - Master's Degree in Telecommunications Engineering
ECTS	5.0
Course	2
Period	First semester
Subject Type	Optional
Module	---

1.Basic info

1.1.Recommendations to take this course

1.2.Activities and key dates for the course

2.Initiation

2.1.Learning outcomes that define the subject

2.2.Introduction

3.Context and competences

3.1.Goals

3.2.Context and meaning of the subject in the degree

3.3.Competences

3.4.Importance of learning outcomes

4.Evaluation

5.Activities and resources

5.1.General methodological presentation

The learning process designed for this course is based on the following tools:

M1. Participatory Lectures (36 hours). Oral (magistral) presentation by the teacher of the main subject contents, combined with the active participation of students. This activity will take place in regular classroom. The methodology, supported by individual work of the student (M14) is designed to provide students with the theoretical foundations of the subject content.

M4: Problem-based learning (10 hours) in which problem solving and practical cases will be performed. The topics will proposed by the teacher, based on the fundamentals presented in lectures, with the possibility of presenting the by students individually or in groups. This public presentation will take place in the classroom.

M9: Lab (4 hours). In which students will take 2 practicum sessions of 2 hours in Signals and Systems Laboratory Building 2.02 Ada Byron. The activity will be done in small groups, with the aim to consolidate the theoretical concepts of biomedical signal acquisition developed throughout the lectures. This activity will be conducted at the Laboratory in person.

M13: Guided practical work (20 hours). Developing a practical case in group, guided by the teacher, and based on the contents of the course.

M14: Theoretical study (52 hours). Personal study related to the "lectures" content, including any personal activity (exams, library related work, further reading, problems and exercises solving, etc.).

M10: Tutoring. Personalized hours dedicate to assist students with the aim of reviewing and discussing the materials and topics presented in both theoretical and practical classes.

M11: Evaluation . (3 hours). Student progress is evaluated by realization of theoretical and practical written tests.

5.2.Learning activities

The program offered to the students in order to help the student to achieve the expected results, includes the following activities

* Lectures, introducing the concepts, the physiological basis of each signal type and the objectives of their study including the particularities, or new signal processing developments, required in these contexts.

* Problem solving, given to the student individually, which after completion, are presented by the student to the course

* Laboratory Practices, which will present students practically, some of the applications presented in class.

* Tutored work, in which a case study, individually or preferably in groups, with some actual data is raised, and the student will develop the appropriate application with a specific clinical purpose.

5.3.Program

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The distribution into thematic units of the theory of the subject is as follows:

Theme 1. Introduction to the biological signals origin, types of signal, characteristics and objectives that ICT can afford in this context.

Theme 2. Electrocardiogram (ECG): description, parameters of clinical interest, interpretation; Event detection (beats); interference cancellation; analysis of heart rate variability; averaged of recurrent signals; Data compression and time-variant analysis (time-frequency representations); invasive signals (electrograms), their use and singularities.

Theme 3. Electroencephalogram (EEG): interpretation and clinical information, frequency bands; cancellation of artifacts; spectral estimation; Analysis of evoked potentials (visual, auditory, etc.).

Theme 4. Electromyogram (EMG): origin and interpretation; parameters of interest and best estimate; applications.

Theme 5. Other biomedical signals: Photoplestimograma (PPG), blood pressure (BP); Their interactions and physiological implications; relations estimates (causality, correlations, etc) Multimodal (different types of signals) of clinical parameters.

Troubleshooting: This activity consists of the resolution, by the student, of problems, guided by the teacher, and subsequent presentation in any of the regulated classes.

Laboratory practices: This activity will be conducted in person in a computer classroom. It will include 2 sessions of 2 hours each. Students then submit a written report containing the main findings of work done.

Tutored work: The tutored work will be based on understanding, development and implementation of parts of a biomedical signal processing system proposed by the teacher. It will be conducted by a working group include the need for coordination and will be assessed by a written report and an oral presentation.

5.4.Planning and scheduling

Sessions Schedule and work presentation

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The timing of the subject, both the regular classes hours, and the laboratory sessions will be defined by the school in the academic calendar of the corresponding course.

5.5.Bibliography and recomended resources

- Sörnmo, Leif and Laguna, Pablo. Bioelectrical signal processing in cardiac and neurological applications / Leif Sörnmo, Pablo Laguna Burlington [Massachusetts] : Elsevier, Academic Press, cop. 2005
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- Gulrajani, Ramesh M. Bioelectricity and Biomagnetism / Gulrajani, Ramesh M John Wiley Sons 1998
- Malmivuo, Jaakko. Bioelectromagnetism: Principles and Applications of Bioelectric and Biomagnetic Fields / Malmivuo, Jaakko, Plonsey, Robert Oxford University Press 1995