

Academic Year/course: 2022/23

## 69720 - Advanced biomedical signal processing

### Syllabus Information

**Academic Year:** 2022/23

**Subject:** 69720 - Advanced biomedical signal processing

**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 where the main contents are presented and discussed; practice sessions with practical examples, demonstrations and problems; autonomous work; and an assignment consisting on the programming, analysis and study of methods for biomedical signal processing on a set of biomedical signals.

#### 4.2. Learning tasks

The learning process that has been designed for this subject is based on the following:

**A01 Participatory master class (24 hours).** Presentation by the teacher of the main contents of the subject. This activity will be carried out in person in the classroom. During the classes practical examples, demonstrations and problems will be carried out.

**A03 Laboratory practices. (6 hours).** 3 practical sessions of 2 hours each will be held in a computer room. A memory of the practices must be presented, which will be evaluated (E3).

**A05 Applied or research practical assignments (20 hours).** There will be practical exercises that students must submit on the dates established by the faculty. These exercises may consist of short questions, problems or small programming tasks, analysis and interpretation of processing methods in provided signals. The student will show the degree of acquisition of the skills corresponding to the subject and will provide interpretations of the results. In the evaluation (E2) the suitability and originality of the proposed solution will be taken into account.

**A06 Tutoring.** Hours of personalized attention to the student with the aim of reviewing and discussing the materials and

topics presented in both theoretical and practical classes.

**A08: Evaluation (2 hours).** The final written test and presentation of works. See the evaluation activities section.

### 4.3. Syllabus

The course will address the following topics:

1. Basics of statistical signal processing.
2. Parameter estimation and detection of events. Applications: Averaging, EMG analysis, delays, heart rate variability, event detection, detection of T-wave alternans ... Methods: Parameter estimation. Bias and variance. Optimal estimation (maximum likelihood, least squares, Bayesian methods).
3. Optimal detection. Applications: event detection, QRS detection, body position changes. Methods: Likelihood ratio test (LRT), Neyman-Pearson criterion, Evaluation of a detector.
4. Optimal and adaptive filtering. Applications: filtering and noise cancellation, source separation, adaptive estimation. Methods: Wiener Filtering, Adaptive Filtering Algorithms (LMS).

### 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

<http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=69720>