

## 69303 - Signal processing and biomedical imaging

### Información del Plan Docente

Academic Year	2017/18
Faculty / School	110 - Escuela de Ingeniería y Arquitectura
Degree	330 - Complementos de formación Máster/Doctorado 547 - Master's in Biomedical Engineering
ECTS	6.0
Year	---
Semester	Indeterminate
Subject Type	ENG/Complementos de Formación, Compulsory
Module	---

### **1.General information**

#### **1.1.Introduction**

#### **1.2.Recommendations to take this course**

#### **1.3.Context and importance of this course in the degree**

#### **1.4.Activities and key dates**

### **2.Learning goals**

#### **2.1.Learning goals**

#### **2.2.Importance of learning goals**

### **3.Aims of the course and competences**

#### **3.1.Aims of the course**

#### **3.2.Competences**

### **4.Assessment (1st and 2nd call)**

#### **4.1.Assessment tasks (description of tasks, marking system and assessment criteria)**

### **5.Methodology, learning tasks, syllabus and resources**

#### **5.1.Methodological overview**

The methodology followed in this course is oriented towards achievement of the learning objectives. It is based on a mixture of sessions devoted to introduce the basics concepts of signal/image processing and a set of interleaved practice sessions devoted to make illustrative exercises and examples that help to understand and to learn these concepts. Computer simulations will take place in most of the sessions, both by the teacher and the students therefore many of the sessions will be in a computer room.

## 69303 - Signal processing and biomedical imaging

### 5.2.Learning tasks

The course includes the following learning tasks:

- **(A01, A02) Lectures** (40 hours). The following activities are related to this learning task: 1. the contents of the course are provided; 2. introduction of applied examples; 3. exercises and problems are solved by the students.
- **(A03) Laboratory sessions** (10 hours). Laboratory sessions (2 hours of duration) are scheduled every 2 weeks.
- **(A05) Assignments**. Once each topic is completed students may be asked to do 1. Exercises or problem solving; 2. Software-based signal or image processing mini-projects; 3. Group reports (3 people).
- **(A06) Tutorials**. The teacher will be available to the students for helping them in their learning process, either in small groups or individually. A minimum of six hours will be offered during each week of the course.
- **(A08) Assessment**. A set of tests will be taken during the course, with either a theoretical or practical orientation. These activities are described in more detail in the Evaluation Section. These activities will help to monitor and to assess the quality of the individual learning process for each student.

### 5.3.Syllabus

The course will address the following topics:

1. Biomedical signals and images.
  - 1.1. Signals: concepts and taxonomy.
  - 1.2. Biomedical signals.
    - o 1.2.1. Bioelectrical signals.
    - o 1.2.2. Medical image modalities.
  - 1.3. Signal measures.
  - 1.4. Transformations of the independent variable.
2. Systems in time domain.
  - 2.1. Systems: concepts, properties and examples.
  - 2.2. Linearity and invariance: convolution and correlation.
3. Frequency domain.
  - 3.1. Discrete Fourier Transform.
  - 3.2. Fourier transforms.
  - 3.3. Sampling and sampling frequency conversion.
  - 3.4. Frequency response of linear invariant systems.
4. Linear invariant systems and z-transform.
  - 4.1. Systems described by difference equations: FIR, IIR.
  - 4.2. Transfer function and frequency response.

### 5.4.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 and the Moodle platform <https://moodle.unizar.es/>.

### 5.5.Bibliography and recommended resources

<b>BB</b>	Ingle, Vinay K . Digital Signal Processing using MATLAB. Vinay K. Ingle and John G. Proakis . Third edition. Cengage Learning, 2012
<b>BB</b>	Semmlov, J. Biosignal and Biomedical Image Processing MATLAB-Based Applications / Semmlov J. Marcel Dekker, 2004
<b>BC</b>	Image Processing with MATLAB:

## 69303 - Signal processing and biomedical imaging

- BB** Applications in Medicine and Biology /  
Omer Demirkaya et al. CRC press, 2006
- BC** Rangayyan, R.M. Biomedical signal  
analysis: A case-study approach /  
Rangayyan, R.M. Wiley-Interscience, 2002
- BB** Oppenheim, Alan Victor. Tratamiento de  
señales en tiempo discreto / Alan V.  
Oppenheim, Ronald W. Schafer ;  
traducción Javier Portillo ; revisión técnica  
Emilio Soria Olivas, Luis Vergara  
Domínguez, Antonio Albiol Colomer ;  
revisión técnica para Latinoamérica  
Alejandro Furfaro ... et al.] . 3ª ed. Madrid :  
Pearson Educación, D.L. 2011
- BB** Sörnmo, Leif. Bioelectrical signal  
processing in cardiac and neurological  
applications / Leif Sörnmo, Pablo Laguna .  
Burlington [Massachusetts] : Elsevier,  
Academic Press, cop. 2005