UNIVERSITAT DE BARCELONA

Teaching plan for the course unit

General information about the course unit

Course unit name: Anàlisi i processament avançat de senyals biomèdics
Course unit code: 560321

Coordinator: RAIMON JANÉ

Other contents

AFFILIATED COURSE UNIT TAUGHT AT THE TECHNICAL UNIVERSITY OF CATALONIA (UPC)

Estimated learning time

Factor hours / ECTS	**25**
Distance or on-line activity	
Self-learning activity	
On-campus activity	
Total number of hours	**0**
ECTS credits	**5**

Learning objectives

Referring to knowledge

With regard to knowledge, students successfully completing the course unit should be able to:
- demonstrate knowledge of analysis and advanced processing techniques through the filtering, detection, characterisation and interpretation of biomedical signals;
- provide a description and demonstrate understanding of these techniques through the

problem-solving approach;
- give examples of applications of different biomedical signals (ECG, EEG, EP, muscular, respiratory signals, etc.) used to obtain relevant clinical information.

Teaching blocks

1. Introduction to the advanced processing of biomedical signals

1.1. Objectives and difficulties

1.2. Analysis of biomedical signals as a tool to assist in diagnosis

1.3. Evaluation of biomedical signal processing methods

2. Filtration to eliminate noise and artefacts

2.1. Types and characteristics of noise and interference of biological origin

2.2. Linear filters

2.3. Adaptive filters

2.4. Noise reduction in signals linked to an event (time averaged signal: homogeneous, exponential, weighted)

2.5. Application in encephalogram (EEG), evoked potential (EP) and (electrocardiogram) ECG signals

3. Event detection

3.1. Detection of waves of interest

3.2. Wave delineation

3.3. Correlation and adapted filter

3.4. Application in ECG and EEG signals

4. Analysis and characterisation of biomedical signals

4.1. Spectral analysis

4.2. Time-frequency analysis (Wigner-Ville, Cohen's class)

4.3. Orthogonal expansions (Karhunen-Loève, Walsh, Fourier, Hermite)

4.4. Wavelets and multiresolution analysis

5. Applications of biomedical signal processing to assist in diagnosis (computer-aided diagnosis)

Teaching methods and general organization

The course will include:
- theoretical content taught during in-class sessions, encouraging students' active participation;
- several practical activities connected with the different course unit elements which will consider problems and the development of analysis and processing programs involving real biomedical signals.

Continuous assessment of this course unit will be conducted at two levels:
- students will carry out the practical activities and submit the anticipated data as part of their continuous assessment;
- in a final examination at the end of the course unit lectures, students will be required to make an oral presentation of some of the activities carried out.

Official assessment of learning outcomes

Grading of the continuous assessment will be divided as follows:

- practical work will account for 75% of the final grade;
- the final examination will count for the remaining 25%.

Reading and study resources

Book

Rangaraj M. Rangayyan. *Biomedical Signal Analysis. A Case-Study Approach*. IEEE Press,Wiley-Interscience. 2002.

Leif Sörnmo and Pablo Laguna. *Bioelectrical Signal Processing in Cardiac and Neurological Applications*. Elsevier, Academic Press. 2005.

Eugene N. Bruce. *Biomedical Signal Processing and Signal Modeling*. Wiley-Interscience. 2001.