Universidad Zaragoza

69303 - Signal processing and biomedical imaging

Información del Plan Docente

Academic Year	2018/19
Subject	69303 - Signal processing and biomedical imaging
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	XX
Semester	Indeterminate
Subject Type	ENG/Complementos de Formación, Compulsory
Module	---

1.General information

1.1.Aims of the course

1.2.Context and importance of this course in the degree

1.3.Recommendations to take this course

2.Learning goals

2.1.Competences

2.2.Learning goals

2.3.Importance of learning goals

3.Assessment (1st and 2nd call)

3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

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. 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.

4.2.Learning tasks

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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.
- **(A03) Laboratory sessions** (10 hours).
- **(A05) Periodic assignments**. 1. Exercises or problem solving; 2. Software-based signal or image processing miniprojects; 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**.

4.3.Syllabus

The course will address the following topics:

1. Biomedical signals and images.
1.1. Signals and biomedical signals.
1.2. Images and biomedical images (modalities).
1.3. Bioelectric signals:
1.3.1.Action potential.
1.3.2.ECG signal.
2. Mathematical foundations of signal processing.
2.1. Signals as functions.
2.1.1.Real/complex valued signals, mono/multidimensional signals.
2.1.2.Basic signals: pure frequencies, step, Dirac.
2.1.3.Time warping. Periodicity. Symmetry.
2.1.4.Energy and power signals.
2.2. Signals as sequences. Sampling.
2.3. Signals as vectors. Dot product.
2.4. Correlation.
3. Signals in frequency domain.
3.1. Discrete Fourier Transform (DFTN).
3.2. Continuous-time Fourier Transform (CTFT). Discrete-time Fourier Transfrom (DTFT).
3.3. Special pairs, properties and example applications.
4. Systems in time and frequency domain.
4.1. Systems' properties.
4.2. Linear Invariant systems. Convolution and frequency response.
5. FIR and IIR discrete-time filtering.
5.1. Z transform.
5.2. Structures for discrete-time systems and linear constant coefficient difference equations.
5.3. Frequency response for rational transfer function systems.

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 and the Moodle platform https://moodle.unizar.es/.

4.5.Bibliography and recommended resources

BB	Ingle, Vinay K . Digital Signal Processing using MATLAB. V K. Ingle and John G. Proakis . Third edition. Cengage Lear 2012

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BB   Semmlov, J. Biosignal and Biomedical Image Processing MATLAB-Based Applications / Semmlov J. Marcel Dekker,

BC   Image Processing with MATLAB: Applications in Medicine 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 ; traducc Javier Portillo ; revisión técnica Emilio Soria Olivas, Luis Ve 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 . Bu [Massachusetts] : Elsevier, Academic Press, cop. 2005