

Academic Year: (2024 / 2025)

Review date: 02-02-2024

Department assigned to the subject: Bioengineering Department

Coordinating teacher: IZQUIERDO GARCÍA, DAVID

Type: Compulsory ECTS Credits : 6.0

Year : 1 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

- Signals and systems
- Fundamentals of bioengineering
- Differential equations
- Image processing

OBJECTIVES

The 'Biosignals and Bioimages' course deepens in the understanding of the BioSignals and Bioimages initiated on the Introduction course. During this course we will analyze in detail the processes related to detecting, obtaining, recording and analyzing the different BioSignal and Bioimages that can be later on used in pre-clinical and clinical applications. We will deepen on the physical and physiological origin of the different signals and images. During this course we will explore different modalities, such as ECG, EEG, MRI, CT or PET among others. We will study the physical devices, tools and methods that enable the acquisition and recording of their signals and images. We will discover the fundamental methods behind signal and image processing to record and analyze the data obtained from BioSignal and Bioimages, on 1D, 2D, 3D and even 4D.

DESCRIPTION OF CONTENTS: PROGRAMME

Biosignals:

Sources of physiological signals and images: physical principles, acquisition, clinical use

Methods of biomedical signal acquisition.

Information extraction, advanced processing, diagnostic aids

Applications: ECG, EEG, others

Modeling

Bioimages:

2d, 3D and nD image

Physics of medical imaging

Identification of biomarkers

Electromagnetic radiation and its effects on biological tissue.

Molecular and multimodal imaging concept

Image quantification: dynamic data, parametric images, kinetic analysis

DICOM information model and its use for the transmission of files

LEARNING ACTIVITIES AND METHODOLOGY

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|-----|-------------------------------|
| AF3 | Theoretical practical classes |
| AF4 | Laboratory practices |
| AF6 | Team work |
| AF7 | Student individual work |
| AF8 | Partial and final exams |

Activity code	total hours number	presencial hours number	% Student Presence
AF3	84	84	100%
AF4	63	63	100%
AF6	90	0	0%
AF7	222	0	0%
AF8	9	9	100%
TOTAL SUBJECT	468	156	33,3%

ASSESSMENT SYSTEM

% end-of-term-examination:	30
% of continuous assessment (assignments, laboratory, practicals...):	70
SE1	Participation in class
SE2	Individual or team works made during the course
SE3	Final exam

Evaluation systems	Minimum weighting (%)	Maximum Weighting (%)
SE1	0	20
SE2	0	100
SE3	0	100

The extraordinary evaluation (june call) will be carried out with a final exam (SE3) that weighs 100% of the grade.

BASIC BIBLIOGRAPHY

- Sörnmo, Laguna Bioelectrical Signal Processing in Cardiac and Neurological Applications, Elsevier, 2005
- Toenies Guide to Medical Image Analysis, Springer, 2017
- van Drongelen Signal Processing for Neuroscientists, Academic Press, 2018

ADDITIONAL BIBLIOGRAPHY

- Bailey, Townsend, Valk and Maisey Positron Emission Tomography: Basic Sciences, Springer, 2003
- Hendeel, Ritenour Medical Imaging Physics, Wiley, 2002
- McRobbie, Moore, Graves and Prince MRI From Picture to Proton, Cambridge University Press, 2017
- Michael E. Phelps PET Molecular Imaging and Its Biological Applications, Springer, 2004