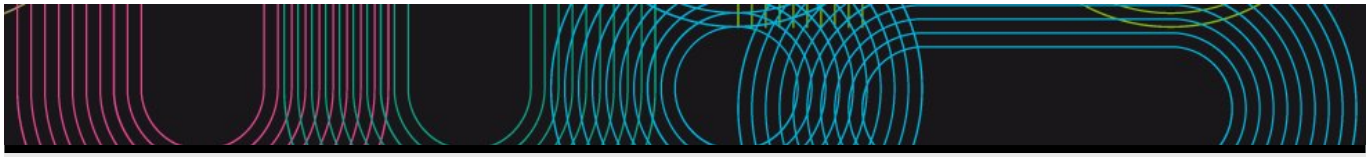

IDENTIFYING DATA				
(*)Sinais biomédicas				
Subject	(*)Sinais biomédicas			
Code	V04M192V01201			
Study programme	Máster Universitario en Ingeniería Biomédica			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	4.5	Mandatory	1st	2nd
Teaching language	Spanish			
Department				
Coordinator	Torres Guijarro, María Soledad			
Lecturers	Torres Guijarro, María Soledad			
E-mail	soledadtorres@uvigo.es			
Web				
General description	In this course we will learn how to process encephalograms, electromyograms and electrocardiograms, extract their characteristics and classify them automatically using machine learning techniques. The learning methodology is "hands-on" using Matlab from the first day. Students must bring their laptop to all classroom sessions.			

Training and Learning Results	
Code	
A3	That students are able to integrate knowledge and handle complexity and formulate judgments based on information that was incomplete or limited, include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgments.
A5	Students must possess the learning skills that enable them to continue studying in a way that will be largely self-directed or autonomous.
B3	Knowledge in basic and technological subjects that will enable students to learn new methods and theories, and provide them the versatility to adapt to new situations.
B6	Capacity for handling specifications, regulations and mandatory standards.
C11	Ability to analyze and interpret signals and images from the biomedical field.

Expected results from this subject	
Expected results from this subject	Training and Learning Results
To know the signal processing techniques, and to apply them to biomedical signals.	A3 A5 B3 B6 C11
To know the techniques of feature extraction and signal dimension reduction, and to apply them to biomedical signals	A3 A5 B3 B6 C11
To know the methods automatic classification systems, and to apply them to biomedical signals	A3 A5 B3 B6 C11

Contents
Topic

Biomedical signal analysis techniques	Introduction to spectral analysis. Power spectral density. Model-based parametric methods. Subspace-based methods for spectral analysis. Time-frequency analysis
Feature extraction and dimension reduction	Feature extraction methods Dimension reduction/feature selection methods.
Biomedical signal classification methods	Performance evaluation metrics. Linear discriminant analysis. K-Nearest Neighbour. Artificial Neural Networks. Support Vector Machines.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	26	23	49
Problem solving	7.5	15	22.5
Mentored work	2	27	29
Essay questions exam	1	0	1
Problem and/or exercise solving	1	0	1
Essay	0	10	10

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Lecturing	Presentation by the teacher of the contents of the subject, fostering the critical discussion of the concepts. The theoretical grounds of algorithms and procedures used to resolve problems are given. With this methodology they work the competences CB3, CB5, CG3, CG6 and CE11.
Problem solving	Theoretical content is complemented by problem solving using the Matlab programme. With this methodology they work the competences CB3, CB5, CG3, CG6 and CE11, individually.
Mentored work	Students apply the contents to a specific case with real signals, consulting the bibliography and using the Matlab programme. This methodology is used to work on the competences CB3, CB5, CG3, CG6 and CE11, in pairs.

Personalized assistance

Methodologies	Description
Lecturing	Doubts can be solved in the rests of the classes and in the teacher tutorial sesions. These tutorial sessions will be done individually or in short groups (with a maximum of 2-3 students). The tutorial sessions are typically agreed with the professor. The meetng requests can be done personally or by email.
Problem solving	Problems sessions are a good moment to consult doubts with the professor. The professor moves between the tables and some students take advantage of the proximity of the professor to consult doubts.

Assessment

	Description	Qualification	Training and Learning Results		
Essay questions exam	Written assessment tests, with long developmental questions.	40	A3 A5	B3 B6	C11
Problem and/or exercise solving	Written evaluation tests, with brief questions and problems.	20	A3 A5	B3 B6	C11
Essay	Assessment of the code and written reports describing the tutored work	40	A3 A5	B3 B6	C11

Other comments on the Evaluation

CONTINUOUS ASSESSMENT

In continuous assessment, there will be two written assessment tests, one in the middle and the other at the end of the term.

In order to pass the course, it is necessary to obtain a score of 4 out of 10 or higher in each of the evaluable activities (two written tests, problems and tutored work).

GLOBAL ASSESSMENT

A written test will be given at the official date at the end of the term, and the problems and the tutored work will be handed

in on the same date. In order to pass the course, it is necessary to obtain a score of 4 out of 10 or higher in each of the evaluable activities.

Sources of information

Basic Bibliography

John L. Semmlow, Benjamin Griffel, **Biosignal and medical image processing**, 978-1-4665-6738-8, 3, CRC Press, 2014

Londa Schiebinger, **Integrating Sex, Gender, and Intersectional Analysis into Bioengineering**, Elsevier, 2022

Complementary Bibliography

Abdulhamit Subasi, **Practical Guide for Biomedical Signals Analysis Using Machine Learning Techniques - A MATLAB based approach**, 1, Academic Press, 2019

Rangaraj M. Rangayyan, **Biomedical signal analysis. A case-study approach**, 1, Wiley-IEEE Press, 2002

Recommendations

Subjects that continue the syllabus

(*)Análise cronobiolóxico de sinais biomédicas/V04M192V01306
(*)Bioinstrumentación. Sistemas de monitorización/V04M192V01305
(*)Tecnoloxías de imaxe médica/V04M192V01301

Subjects that it is recommended to have taken before

(*)Estatística avanzada para a enxeñaría biomédica/V04M192V01101
(*)Métodos matemáticos aplicados á enxeñaria biomédica/V04M192V01102