

[MMD001] ADVANCED BIOSIGNAL PROCESSING

GENERAL INFORMATION

Studies	MASTER'S DEGREE IN BIOMEDICAL TECHNOLOGIES		Subject	Data analysis
Semester	1	Course	1	Mention / Field of specialisation
Character	COMPULSORY		Language	ENGLISH
Plan	2017	Modality	Adapted Face-to-face	Total hours
Credits	6	Hours/week	5.33	96 class hours + 54 non-class hours = 150 total hours

PROFESSORS

AYALA FERNANDEZ, UNAI

REQUIRED PREVIOUS KNOWLEDGE

Subjects	Knowledge
BIOSIGNALS AND SIGNAL PROCESSING	[!] <i>Teoría de muestreo</i>
[!] <i>Procesado digital de bioseñales</i>	[!] <i>Transformada en Z</i>
	[!] <i>Transformada de Fourier</i>
	[!] <i>Filtros digitales</i>

SKILLS

VERIFICA SKILLS

SPECIFIC

MMCE06 - To select and implement advanced knowledge of signal processing in the development of biomedical algorithms.

MMCG01 - Addressing problems in the universe of healthcare by implementing various treatment and/or diagnostic technologies

GENERAL

MMCG04 - Providing a practical and useful interprofessional framework relating to end user's safety for the product or service

CROSS

MMCTR1 - To select one measure or idea out of several and implement them in response to the needs or circumstances emerging in the work process

MMCTR2 - To work with people, getting them involved and guiding them towards the achievement of a common goal, with a global vision of work and its characteristics (quality, deadlines, etc.), taking individual interests into account

BASIC

M_CB7 - To know how to apply the acquired knowledge and competencies and the ability to solve problems in new or unfamiliar contexts within wider (or multidisciplinary) environments related to their field of study

M_CB9 - To share knowledge, conclusions and their rationale with specialised and lay audiences in a clear, unambiguous manner

LEARNING RESULTS

RMM128 To analyze and develop biomedical algorithms based on the frequency representation of biosignals.

LEARNING ACTIVITIES

	CH	NCH	TH
Individual and/or team computer simulation practice	13 h.	8 h.	21 h.
Classroom presentations of relevant concepts and procedures in participatory environments	38 h.	20 h.	58 h.

EVALUATION SYSTEM

	W
Individual written and oral tests to assess technical skills of the subject	75%
Reports of solving exercises, case studies, computer practices, simulation practices and laboratory practices	25%

MAKE-UP MECHANISMS

Individual written and oral tests to assess technical skills of the subject

CH - Class hours: 51 h.

NCH - Non-class hours: 28 h.

TH - Total hours: 79 h.

RMM129 To analyze and develop biomedical algorithms based on advanced signal processing techniques

LEARNING ACTIVITIES		<i>CH</i>	<i>NCH</i>	<i>TH</i>
Individual and/or team computer simulation practice		7 h.	6 h.	13 h.
Classroom presentations of relevant concepts and procedures in participatory environments		10 h.	3 h.	13 h.
EVALUATION SYSTEM		<i>W</i>	MAKE-UP MECHANISMS	
Individual written and oral tests to assess technical skills of the subject		75%	Individual written and oral tests to assess technical skills of the subject	
Reports of solving exercises, case studies, computer practices, simulation practices and laboratory practices		25%		
CH - Class hours: 17 h.				
NCH - Non-class hours: 9 h.				
TH - Total hours: 26 h.				

RMM130 To analyze the variables that are part of the solution to a problem, to plan actions in order to reach a stable solution assuming responsibilities in the work group, organizing and planning tasks.

LEARNING ACTIVITIES		<i>CH</i>	<i>NCH</i>	<i>TH</i>
Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams		11 h.	7 h.	18 h.
EVALUATION SYSTEM		<i>W</i>	MAKE-UP MECHANISMS	
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems		100%	Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	
CH - Class hours: 11 h.				
NCH - Non-class hours: 7 h.				
TH - Total hours: 18 h.				

RMM131 To know and apply problem solving tools in the field of biomedical engineering with initiative, decision -making, creativity and critical thinking.

LEARNING ACTIVITIES		<i>CH</i>	<i>NCH</i>	<i>TH</i>
Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams		11 h.	7 h.	18 h.
EVALUATION SYSTEM		<i>W</i>	MAKE-UP MECHANISMS	
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems		100%	Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	
CH - Class hours: 11 h.				
NCH - Non-class hours: 7 h.				
TH - Total hours: 18 h.				

RMM132 To define the problem, the development of the solution and the conclusions efficiently, arguing and justifying each one of them and using correct written and spoken language.

LEARNING ACTIVITIES		<i>CH</i>	<i>NCH</i>	<i>TH</i>
Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams		3 h.	1,5 h.	4,5 h.

EVALUATION SYSTEM	W	MAKE-UP MECHANISMS
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	100%	Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems
CH - Class hours: 3 h. NCH - Non-class hours: 1,5 h. TH - Total hours: 4,5 h.		

RMM133 To define the objectives, perform the planning for its consecution and to coordinate with the rest of the members of the team.

LEARNING ACTIVITIES	CH	NCH	TH
Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams	3 h.	1,5 h.	4,5 h.
EVALUATION SYSTEM	W	MAKE-UP MECHANISMS	
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	100%	Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	
CH - Class hours: 3 h. NCH - Non-class hours: 1,5 h. TH - Total hours: 4,5 h.			

CONTENTS

1.- Time-frequency analysis

§Introduction

§Short-Term Fourier Transform: The spectrogram

§The Wigner-Ville Distribution

§The analytic signal

§Choi-Williams and other Distributions

2.- Wavelet Analysis

§Introduction

§Time-frequency characteristics

§The Discrete Wavelet Transform (DWT)

§Application

3.- Spectral analysis

§Introduction

§Parametric methods

§Non-parametric methods

4.- Optimal and adaptive filtering

§Introduction

§Optimal Signal Processing: Wiener Filters

§Adaptive Signal Processing

5.- Multivariate Analysis

§Introduction

§PCA

§ICA

LEARNING RESOURCES AND BIBLIOGRAPHY

Learning resources

Bibliography

Subject notes

Biosignal and Biomedical Image Processing MATLAB based Applications - John L. Semmlow
"Bioelectrical Signal Processing for Cardiac and Neurological Applications", Sormno & Laguna
"Biomedical Analysis- A case - study approach", Rangayyan
"Advanced Methods and Tools for ECG data analysis"- Clifford, Azuaje & McSharry