[MMD100] ADVANCED BIOSIGNAL TREATMENT

GENERAL INFORMATION

Studies	MASTER'S DEGREE IN BIOMEDICAL TECHNOLOGIES			**Subject**	?
Semester	2	**Course**	1	**Mention / Field of specialisation**	
Character	COMPULSORY				
Plan	2023	**Modality**	Face-to-face	**Language**	ENGLISH
Credits	4,5	**Hours/week**	3.73	**Total hours**	67.2 class hours + 45.3 non-class hours = **112.5 total hours**

PROFESSORS

BARRENETXEA CARRASCO, MAITANE

REQUIRED PREVIOUS KNOWLEDGE

Subjects	Knowledge
SIGNAL AND BIOMEDICAL IMAGES PROCESSING	Sampling theory
Biomedical signal processing	Z transform
	Fourier transform
	Digital filters

LEARNING RESULTS

LEARNING RESULTS	KC	SK	AB	ECTS
MMRA19 - Constructing biomedical signal processing algorithms for diagnosis and prognosis in the healthcare field		*x*		3,16
MMR-26 - To apply the knowledge acquired and your problem-solving skills in new, little-known or changing environments within broader (or multidisciplinary) contexts related to your area of study		*x*		1,08
MMR-28 - To communicate your conclusions and the knowledge and ultimate reasons that support them to specialized and non-specialized audiences in a clear and unambiguous way		*x*		0,26
			Total:	**4,5**

KC: Knowledge or Content / SK: Skills / AB: Abilities

SECONDARY LEARNING RESULTS

RMM147 **[!]** ***Define los objetivos, realiza la planificación para su consecución y su seguimiento sistemático coordinando su trabajo con los demás miembros del equipo.***

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	2 h.	1 h.	3 h.

EVALUATION SYSTEM	W
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	50%
Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems	50%

MAKE-UP MECHANISMS

Observation (technical capacity, attitude and participation)

CH - Class hours: 2 h.
NCH - Non-class hours: 1 h.
TH - Total hours: 3 h.

RMM145 **[!]** ***Conoce y es capaz de aplicar las herramientas de resolución de problemas en el campo de la Ingeniería Biomédica con iniciativa, toma de decisiones, creatividad y razonamiento crítico.***

LEARNING ACTIVITIES	CH	NCH	TH
Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams	8,5 h.	5 h.	13,5 h.

EVALUATION SYSTEM	W
Individual written and/or oral tests or individual coding/programming tests	40%
Co-assessment	5%
Prototype / Product	55%

Comments: If the score of the defense is lower than 5, this evaluation item will be evaluated in its entirety (%100) with the score of the defense. A co-evaluation system will be implemented to adjust the score of the student based on his or her participation in the Project.

MAKE-UP MECHANISMS

Observation (technical capacity, attitude and participation)

CH - Class hours: 8,5 h.
NCH - Non-class hours: 5 h.
TH - Total hours: 13,5 h.

RMM110 **[!]** ***Analizar y desarrollar algoritmos biomédicos basados en la representación frecuencial de señales biomédicas***

LEARNING ACTIVITIES	CH	NCH	TH
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	2 h.	2,5 h.	4,5 h.
Computer simulation exercises, individually and/or in teams	6 h.	2,5 h.	8,5 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	8 h.	5 h.	13 h.

EVALUATION SYSTEM	W
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	25%
Individual written and/or oral tests or individual coding/programming tests	75%

Comments: If the score of the exam is lower than 4, this evaluation item will be evaluated in its entirety (%100) with the score of the exam.

MAKE-UP MECHANISMS

Individual written and/or oral tests or individual coding/programming tests

Comments: : If the score of the exam is lower than 5, it will be mandatory to repeat the exam. The final grade will consist of 25% from the first exam and 75% from the recovery exam.

CH - Class hours: 16 h.
NCH - Non-class hours: 10 h.
TH - Total hours: 26 h.

RMM144 **[!]** ***Analiza las variables intervinientes en la solución de los problemas y plantea acciones para lograr una situación estable asumiendo responsabilidades en el equipo de trabajo, afrontando contingencias y organizando y planificando tareas.***

LEARNING ACTIVITIES	CH	NCH	TH
Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams	8,5 h.	5 h.	13,5 h.

EVALUATION SYSTEM	W
Individual written and/or oral tests or individual coding/programming tests	40%
Co-assessment	5%
Prototype / Product	55%

Comments: If the score of the defense is lower than 5, this evaluation item will be evaluated in its entirety (%100) with the score of the defense. A co-evaluation system will be implemented to adjust the score of the student based on his or her participation in the Project.

MAKE-UP MECHANISMS

Observation (technical capacity, attitude and participation)

CH - Class hours: 8,5 h.
NCH - Non-class hours: 5 h.
TH - Total hours: 13,5 h.

RMM146 **[!]** ***Define el problema, el desarrollo de la solución, así como las conclusiones de manera eficaz, argumentando y justificando cada una de ellas, y haciendo un uso correcto del lenguaje, por escrito y de manera oral.***

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	2,2 h.	1,3 h.	3,5 h.

EVALUATION SYSTEM	W
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	50%
Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems	50%

MAKE-UP MECHANISMS

Observation (technical capacity, attitude and participation)

CH - Class hours: 2,2 h.
NCH - Non-class hours: 1,3 h.
TH - Total hours: 3,5 h.

RMM111 **[!]** ***Analizar y desarrollar algoritmos biomédicos basados en técnicas avanzadas de tratamiento de señal***

LEARNING ACTIVITIES	CH	NCH	TH
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	2 h.	5 h.	7 h.
Computer simulation exercises, individually and/or in teams	12 h.	8 h.	20 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	16 h.	10 h.	26 h.

EVALUATION SYSTEM	W
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	25%
Individual written and/or oral tests or individual coding/programming tests	75%

Comments: If the score of the exam is lower than 4, this evaluation item will be evaluated in its entirety (%100) with the score of the exam.

MAKE-UP MECHANISMS

Individual written and/or oral tests or individual coding/programming tests

Comments: : If the score of the exam is lower than 5, it will be mandatory to repeat the exam. The final grade will consist of 25% from the first exam and 75% from the recovery exam.

CH - Class hours: 30 h.
NCH - Non-class hours: 23 h.
TH - Total hours: 53 h.

CONTENTS

1.- Time-frequency analysis

§Introduction

§Short-term Fourier Transform: the spectrogram

§Wigneer-Ville distribution

§ The analytic signal

§Choi-Williams and other distributions

2.- Wavelet Analysis

§Introduction

§Time-frequency characteristics

§Discrete Wavelet transform (DWT)

§Aplications

3.- Optimum and adaptive filters

§Introduction

§Optimum filters: Wiener filter

§Adaptive signal processing

LEARNING RESOURCES AND BIBLIOGRAPHY

Learning resources	Bibliography
Slides of the subject	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