[GBI202] BIOMEDICAL SIGNAL AND IMAGE PROCESSING

GENERAL INFORMATION

Studies	DEGREE IN BIOMEDICAL ENGINEERING			**Subject**	SIGNAL PROCESSING
Semester	2	**Course**	2	**Mention / Field of specialisation**	
Character	COMPULSORY				
Plan	2022	**Modality**	Face-to-face	**Language**	EUSKARA
Credits	6	**Hours/week**	5.25	**Total hours**	94.5 class hours + 55.5 non-class hours = **150 total hours**

PROFESSORS

AYALA FERNANDEZ, UNAI

REQUIRED PREVIOUS KNOWLEDGE

Subjects	**Knowledge**
(No specific previous subjects required)	*(No previous knowledge required)*

LEARNING RESULTS

LEARNING RESULTS	KC	SK	AB	ECTS
GBR212 - To develop systems for the acquisition of biomedical signals		x		5,4
G-RTR1 - To develop interdisciplinary projects specific to their specialty and of gradual complexity, - becoming aware of respect for human rights and fundamental rights, and analyzing and assessing the impact of the proposed solutions on the SDGs - to acquire and/or apply basic, advanced and /or avant-garde, demonstrating the ability to work in multidisciplinary teams and/or undertake further studies with a high degree of autonomy		x		0,32
G-RTR2 - To express information, ideas and the arguments that support them in an orderly, clear and coherent manner, orally and in writing, based on quality information, self-made or obtained from different sources, using inclusive and non-discriminatory language		x		0,28
			Total:	6

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

SECONDARY LEARNING RESULTS

RGB290 [!] *Proponer los objetivos y la planificación de un proyecto que le permita adquirir y/o reforzar los conocimientos de tecnologías propias de su especialidad,- que en ocasiones llegan a la vanguardia del conocimiento- y definir una estrategía de aprendiz*

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 h.	4 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 Observation (technical capacity, attitude and participation)

CH - Class hours: 3 h.
NCH - Non-class hours: 1 h.
TH - Total hours: 4 h.

RGB291 [!] *Establecer las responsabilidades de los miembros del equipo utilizando técnicas adecuadas para fomentar la eficiencia del equipo para el desarrollo del proyecto en los plazos establecidos (compartir recursos, aportar ideas, habilidades comunicativas*

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.	2 h.	4 h.

EVALUATION SYSTEM	W	MAKE-UP MECHANISMS

Self-assessment	25%	Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems
Co-assessment	25%	
Observation (technical capacity, attitude and participation)	50%	Observation (technical capacity, attitude and participation)

CH - Class hours: 2 h.
NCH - Non-class hours: 2 h.
TH - Total hours: 4 h.

RGB293 [!] *Redacta y estructura correctamente la memoria del proyecto, haciendo un uso correcto, inclusivo y no discriminatorio del lenguaje. Para ello, busca y hace uso de las fuentes de información adecuadas.*

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 h.	4 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
		Observation (technical capacity, attitude and participation)

CH - Class hours: 3 h.
NCH - Non-class hours: 1 h.
TH - Total hours: 4 h.

RGB294 [!] *Realiza una presentación oral del proyecto con argumentos elaborados por sí mismos y haciendo un uso correcto, inclusivo y no discriminatorio del lenguaje.*

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	MAKE-UP MECHANISMS
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	100%	Observation (technical capacity, attitude and participation)

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

RGB226 [!] *Aplica el teorema de muestreo, identifica las propiedades en tiempo discreto y conoce el análisis en el dominio temporal y en la transformada en Z*

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	10 h.	6 h.	16 h.
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	4 h.	2 h.	6 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and	20 h.	12 h.	32 h.

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Superior

procedures associated with the subjects

Carrying out exercises and solving problems individually and/or in teams

| | 13 h. | 7 h. | 20 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	40%	Individual written and/or oral tests or individual coding/programming tests
Individual written and/or oral tests or individual coding/programming tests	60%	

Comments: PBL 10% Practices 30% EP 60%

CH - Class hours: 47 h.
NCH - Non-class hours: 27 h.
TH - Total hours: 74 h.

RGB227 [!] *Aplica el análisis frecuencial para el procesamiento de señales y usa filtros digitales para mejorar las señales*

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	16 h.	10 h.	26 h.
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	2 h.		2 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	11,5 h.	7,5 h.	19 h.
Carrying out exercises and solving problems individually and/or in teams	8 h.	6 h.	14 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	45%	Individual written and/or oral tests or individual coding/programming tests
Individual written and/or oral tests or individual coding/programming tests	55%	

Comments: PBL 30% Practice 15% (Min 4 EP) EP 55%

CH - Class hours: 37,5 h.
NCH - Non-class hours: 23,5 h.
TH - Total hours: 61 h.

CONTENTS

1. Signals and systems1.1. Introduction1.2. Classification of signals and systems1.3. Analog to discrete conversion1.4. Discrete signals1.5. Discrete systems1.6. Discrete systems analysis1.7. Correlation

2. Z –transform2.1. Introduction2.2. Z direct transform2.3. Z inverse transform2.4. Properties2.5. Linear system analysis

3. Frequency analysis3.1. Introduction3.2. Fourier series3.3. Fourier transform3.4. Fourier transform for discrete signals3.5. Properties3.6. Discrete Fourier Transform (DFT)3.7. Application of DFT

4. Digital filters4.1. Introduction4.2. Filter types4.3. Properties4.4. FIR filters4.5. IIR filters

LEARNING RESOURCES AND BIBLIOGRAPHY

Learning resources	Bibliography
Moodle Platform	Oppenheim, A. V. (1999). Discrete-time signal processing. Pearson Education India
Class presentations	
Video projections	Proakis, J. G., & Manolakis, D. (1995). Digital Signal Processing, Algorithms and Applications. Prentice-Hall, New-York
Specific Master Software	
Computer practical training	