

[GBH202] MEDICAL IMAGING SYSTEMS

GENERAL INFORMATION

Studies	DEGREE IN BIOMEDICAL ENGINEERING		Subject	?
Semester	1	Course	3	Mention / Field of specialisation
Character	COMPULSORY		Language	ENGLISH
Plan	2022	Modality	Face-to-face	Total hours
Credits	6	Hours/week	4.58	82.4 class hours + 67.6 non-class hours = 150 total hours

PROFESSORS

BARRENETXEA CARRASCO, MAITANE

REQUIRED PREVIOUS KNOWLEDGE

Subjects	Knowledge
MATHEMATICS II	(No previous knowledge required)
MATHEMATICS I	
MATHEMATICS III	
PHYSICS II	
PHYSICS III	
COMPUTER FOUNDATIONS	

LEARNING RESULTS

LEARNING RESULTS	KC	SK	AB	ECTS
GBR303 - To analyze the operation of medical imaging equipment and apply image processing techniques to improve and parameterize the images obtained.			x	5,08
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		0,44
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		0,48
Total:				6

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

SECONDARY LEARNING RESULTS

RGB390 [!] *Definir y gestionar los objetivos y la planificación de un proyecto que le permita adquirir y/o reforzar los conocimientos de tecnologías específicas de su especialidad,- que en ocasiones llegan a la vanguardia del conocimiento- y definir una estrate*

LEARNING ACTIVITIES

Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams

CH

2,5 h.

NCH

1,5 h.

TH

4 h.

EVALUATION SYSTEM

Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems

W

100%

MAKE-UP MECHANISMS

Observation (technical capacity, attitude and participation)

CH - Class hours: 2,5 h.

NCH - Non-class hours: 1,5 h.

TH - Total hours: 4 h.

RGB391 [!] *Coordinar el equipo de trabajo, estimulando la cohesión y buen clima para lograr la integración de todas las personas y su contribución para alcanzar un rendimiento apropiado, tanto a nivel individual como grupal, para el desarrollo del proyecto en*

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

2,5 h.

1,5 h.

4 h.

EVALUATION SYSTEM

W

MAKE-UP MECHANISMS

Self-assessment

25%

Observation (technical capacity, attitude and participation)

Co-assessment

25%

Observation (technical capacity, attitude and participation)

50%

CH - Class hours: 2,5 h.

NCH - Non-class hours: 1,5 h.

TH - Total hours: 4 h.

RGB392 [!] *Identificar y argumentar de forma precisa los ODS en los que incide el proyecto realizado, aportando posibles acciones para la mejora.*

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

1,9 h.

1,1 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: 1,9 h.

NCH - Non-class hours: 1,1 h.

TH - Total hours: 3 h.

RGB393 [!] *Elabora la memoria del proyecto, aportando argumentos elaborados y haciendo un uso correcto, inclusivo y no discriminatorio del lenguaje.*

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

3,75 h.

2,25 h.

6 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: 3,75 h.

NCH - Non-class hours: 2,25 h.

TH - Total hours: 6 h.

RGB394 [!] *Realiza una presentación oral del proyecto, justificando las soluciones propuestas con argumentos elaborados y precisos, y haciendo un uso correcto, inclusivo y no discriminatorio del lenguaje.*

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

3,75 h.

2,25 h.

6 h.

EVALUATION SYSTEM

W

MAKE-UP MECHANISMS

Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work, term projects, end of degree

100%

Observation (technical capacity, attitude and participation)

project, master's thesis, challenges and problems

CH - Class hours: 3,75 h.

NCH - Non-class hours: 2,25 h.

TH - Total hours: 6 h.

RGB306 [!] *Conoce y comprende el funcionamiento de los equipos de imagen médica basados en rayos X.*

LEARNING ACTIVITIES

	<i>CH</i>	<i>NCH</i>	<i>TH</i>
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	2 h.	6 h.	8 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	20 h.	9,5 h.	29,5 h.
Carrying out exercises and solving problems individually and/or in teams	5 h.	8 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	20%
Individual written and/or oral tests or individual coding/programming tests	80%

MAKE-UP MECHANISMS

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

CH - Class hours: 27 h.

NCH - Non-class hours: 23,5 h.

TH - Total hours: 50,5 h.

RGB307 [!] *Conoce y comprende el funcionamiento de los equipos de imagen médica basados en radiación electromagnética no ionizante.*

LEARNING ACTIVITIES

	<i>CH</i>	<i>NCH</i>	<i>TH</i>
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	2 h.	6 h.	8 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	20 h.	10 h.	30 h.
Carrying out exercises and solving problems individually and/or in teams	2 h.	2,5 h.	4,5 h.
Practical work in workshops and/or laboratories, individually and/or in teams	2 h.	6 h.	8 h.

EVALUATION SYSTEM

W

Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	20%
Individual written and/or oral tests or individual coding/programming tests	80%

MAKE-UP MECHANISMS

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

CH - Class hours: 26 h.

NCH - Non-class hours: 24,5 h.

TH - Total hours: 50,5 h.

RGB308 [!] *Conoce y comprende el funcionamiento de los equipos de imagen médica basados en ultrasonidos.*

LEARNING ACTIVITIES

	<i>CH</i>	<i>NCH</i>	<i>TH</i>
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	1 h.	4 h.	5 h.

Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	10 h.	5 h.	15 h.
Carrying out exercises and solving problems individually and/or in teams	2 h.	1 h.	3 h.
Practical work in workshops and/or laboratories, 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	20%	Individual written and/or oral tests or individual coding/programming tests	
Individual written and/or oral tests or individual coding/programming tests	80%		
CH - Class hours: 15 h.			
NCH - Non-class hours: 11 h.			
TH - Total hours: 26 h.			

CONTENTS

- 1.- X-Rays
 - 1.1.-Introduction
 - 1.2.-Principles of radiology
 - 1.3.- X-Ray generation
 - 1.4.-Interaction with matter
 - 1.5.-X-Ray detectors
 - 1.6.-Other medical uses
 - 1.7.-The risk of using X-rays

- 2.- Computed Tomography
 - 2.1.- Introduction
 - 2.2.- X-ray source and collimation
 - 2.3.- CT detectors
 - 2.4.- CT reconstruction methods

- 3.- Ultrasound Imaging
 - 3.1.-Introduction
 - 3.2.-Principles of ultrasound imaging
 - 3.3.-Physics of ultrasound
 - 3.4.-Transducers
 - 3.5.-Imaging modalities
 - 3.6.-Doppler ultrasound

- 4.- Magnetic Resonance Imaging
 - 4.1.-Introduction
 - 4.2.-Microscopic magnetization

-
- 4.3.-Macroscopic magnetization
 - 4.4.-Precession and Larmor frequency
 - 4.5.-Transverse and Longitudinal Magnetization
 - 4.6.-RF excitation
 - 4.7.-Relaxation
 - 4.8.-Spin Echoes
 - 4.9.-Basic Contrast mechanisms
 - 4.10.-Instrumentation
 - 4.11.-MRI data acquisition

LEARNING RESOURCES AND BIBLIOGRAPHY

Learning resources

Subject notes
Class presentations
Video projections
Computer practical training

Bibliography

Medical Imaging, Signals and Systems, second edition; J.L. Prince and J.M.Links. Pearson 2015.
Fundamentals of Medical Imaging, second edition; P. Suetens. Cambridge University Press 2009.
Introduction to Biomedical Engineering; J. Enderle and J. Bronzino. Elsevier 2011.
Encyclopedia of Medical Devices and Instrumentation, Vol. 2; J.G. Webster.
Intermediate Physics for Medicine and Biology; R. Hobbie and B. Roth. Springer 2007