**Goi Eskola Politeknikoa | Mondragon Unibertsitatea**
Course: 2023 / 2024 - Course planning

# [GBI203] BIOMEDICAL IMAGE PROCESSING

## GENERAL INFORMATION

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|---|---|---|---|---|---|
| **Studies** | DEGREE IN BIOMEDICAL ENGINEERING | | | **Subject** | ? |
| **Semester** | 2 | **Course** | 3 | **Mention / Field of specialisation** | |
| **Character** | COMPULSORY | | | | |
| **Plan** | 2022 | **Modality** | Face-to-face | **Language** | EUSKARA |
| **Credits** | 3 | **Hours/week** | 2.38 | **Total hours** | 42.9 class hours + 32.1 non-class hours = **75 total hours** |

## PROFESSORS

TERMENON CONDE, MAITE

## REQUIRED PREVIOUS KNOWLEDGE

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

## 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 | 2,56 |
| **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 | | 0,2 |
| **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 | | 0,24 |
| | | | **Total:** | 3 |

*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 | 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 | 1,25 h. | ,75 h. | 2 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:** 1,25 h.
**NCH - Non-class hours:** ,75 h.
**TH - Total hours:** 2 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 | 1,25 h. | ,75 h. | 2 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:** 1,25 h.
**NCH - Non-class hours:** ,75 h.
**TH - Total hours:** 2 h.

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**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 | ,6 h. | ,4 h. | 1 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:** ,6 h.
**NCH - Non-class hours:** ,4 h.
**TH - Total hours:** 1 h.

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**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 | 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.

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**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 | 1,9 h. | 1,1 h. | 3 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 project, master's thesis, 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.

**RGB309** [!] *Argumenta la selección de las teorias más relevantes que permitan solucionar un problema de procesamiento de imágenes biomédicas*

| 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 | 5 h. | 3 h. | 8 h. |
| 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 h. | | 1 h. |
| Computer simulation exercises, individually and/or in teams | 4 h. | 7 h. | 11 h. |
| Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects | 9 h. | 3 h. | 12 h. |

| EVALUATION SYSTEM | W |
|---|---|
| Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems | 20% |
| 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 | 30% |
| Individual written and/or oral tests or individual coding/programming tests | 50% |

**MAKE-UP MECHANISMS**

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

**CH - Class hours:** 19 h.
**NCH - Non-class hours:** 13 h.
**TH - Total hours:** 32 h.

**RGB310** [!] *Aplica técnicas para el procesamiento digital de imágenes biomédicas y analiza sus resultados*

| 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 | 6 h. | 6 h. | 12 h. |
| Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints | 1 h. | | 1 h. |
| Computer simulation exercises, individually and/or in teams | 7 h. | 9 h. | 16 h. |
| Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects | 3 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% |
| Individual written and/or oral tests or individual coding/programming tests | 50% |

**MAKE-UP MECHANISMS**

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

**CH - Class hours:** 17 h.
**NCH - Non-class hours:** 15 h.
**TH - Total hours:** 32 h.

## CONTENTS

1. Introduction

1. Introduction to image processing

2. Quality parameters on images

3. Noise on images

2. Intesity transformation and filtering in the spatial filtering

1. Basic strategies for intensity transformation

2. Histogram processing

3. Spatial filtering

4. Low pass and high pass filters

3. Morphological Operations and Segmentation

1. Segmentation

2. Morphological Operations

| LEARNING RESOURCES AND BIBLIOGRAPHY | |
|---|---|
| **Learning resources** | **Bibliography** |
| Computer practical training<br>Slides of the subject<br>Moodle Platform | Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, Digital Image Processing Using MATLAB, Gatesmark Publising, 2009.<br>M. Rangayyan. Biomedical Image Analysis. CRC PRESS, 2005. |