Coi Eskola Politeknikoa Escuela Politécnica Superior

| | [MMD102] DIGI | TAL IN | | ESSING | | | | |
|---|--|----------------------------|--|-------------------------------|----------|----------|-------------|--------------------|
| | GENE | RAL INI | FORMATION | | | | | |
| Studies MASTER'S DE TECHNOLOGI | GREE IN BIOMEDICAL ES | | Subject | ? | | | | |
| Semester 1 | Course 1 | | Mention / Field of | | | | | |
| Character COMPULSOR | ŕ | | specialisation | | | | | |
| Plan 2023 | Modality Face- | to-face | Language | ENGLISH | | | | |
| Credits 4,5 | Hours/week 3.84 | | Total hours | 69.2 class hou total hours | rs + 43 | 3.3 non | -class hou | urs = <u>112.5</u> |
| | l l | PROFE | SSORS | | | | | |
| MENDICUTE ERRASTI, M | IKEL | | | | | | | |
| | REQUIRED | PREVIC | | GE | | | | |
| Sub | jects | | | Know | ledge |) | | |
| SIGNAL AND BIOMEDICAL IMAC | JES PROCESSING | | (1 | No previous kno | wledg | e requi | ired) | |
| [!] Procesamiento de senales bion | iédicas | | | | | | | |
| [1] | | RNING | RESULTS | | | | | |
| LEARNING RESULTS | | | REGOLIO | | кс | SK | AB | ECTS |
| MMRA11 - To develop image proc | essing systems applied to b | oiomedica | l engineering | | | | x | 3,16 |
| MMRA26 - To apply the knowledge | acquired and your probler ader (or multidisciplinary) or | n-solving | skills in new, little-know | own or | | x | | 1,08 |
| MMRA28 - To communicate your of | conclusions and the knowle | dge and u | Itimate reasons that | support them | | x | | 0,26 |
| to specialized and non-specialized | d audiences in a clear and u | unambigue | ous way | | | | | |
| | | | | | | | Total: | 4,5 |
| KC: Knowledge or Content / SK: Skills / A | B: Abilities | | | | | | | |
| | SECONDAI | RY LEA | RNING RESULT | ΓS | | | | |
| RMM125 [!] Especificar y apl | icar correctamente algori | tmos para | a la reconstrucción | de imágenes. | | | | |
| LEARNING ACTIVITIES | | | | СН | | NCH | TH | l |
| Carrying out/resolving projects/ interdisciplinary contexts, real a | challenges/cases, etc. to pl and/or simulated, individual | rovide solı y and/or iı | utions to problems in n teams | 3 h. | | 3 h. | 6 h | I. |
| Presentation by the teacher in the procedures associated with the | he classroom, in participato subjects | ory classe | s, of concepts and | 4 h. | | 2 h. | 6 h | I. |
| EVALUATION SYSTEM | | W | MAKE-UP MECH | ANISMS | | | | |
| Reports on the completion of e computer exercises, simulation | xercises, case studies, exercises, laboratory | 70% | Individual written a coding/programmi | and/or oral tests | s or ind | lividual | I | |
| exercises, term projects, challe | nges and problems | 30% | Comments: If the mandatory to repea | score of the ex t the exam | am is l | lower th | han 5, it V | Vill be |
| coding/programming tests | | | | | | | | |
| Comments: If the score of the evaluation item will be evaluated of the evam | exam is lower than 4, this in its entirety (%100) with t | he score | | | | | | |
| | | | | | | | | |
| CH. Class hours 7 h | | | | | | | | |
| NCH - Non-class hours: 7 h. NCH - Non-class hours: 5 h. TH - Total hours: 12 h. | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| RMM147 [!] Define los objeti trabajo con los demás miembi | vos, realiza la planificació ros del equipo. | in para su | ı consecución y su | seguimiento s | istem | ático c | oordinan | ido su |
| LEARNING ACTIVITIES | | | | СН | | NCH | Th | 1 |

| W | MAKE-UP MECHANISMS |
|-----|--|
| 50% | Observation (technical capacity, attitude and participation) |
| 50% | |
| | |
| | W 50% 50% |

| LEARNING ACTIVITIES | | | СН | NCH | ТН | |
|--|-----------------------------|---|------|------|-------|--|
| Development and writing of records, reports, presentation projects/work experience/challenges/case studies/experin individually and/or in teams | is, audiovis nental inve | sual material, etc. on estigations carried out | 4 h. | 3 h. | 7 h. | |
| Carrying out/resolving projects/challenges/cases, etc. to p interdisciplinary contexts, real and/or simulated, individual | provide sol lly and/or i | utions to problems in n teams | 7 h. | 4 h. | 11 h. | |
| EVALUATION SYSTEM | W | MAKE-UP MECHAN | SMS | | | |
| Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems | 70% | 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 | | | | |
| Individual written and/or oral tests or individual 30% mandatory to repeat th coding/programming tests Comments: If the score of the exam is lower than 4, this | | | | | | |
| evaluation item will be evaluated in its entirety (%100) with of the exam. | the score | | | | | |

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 | СН | NCH | тн | | |
|---|-----|------------------------|---------------|------------------|------------|
| 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 h. | 5,5 h. | 13,5 h. |
| EVALUATION SYSTEM W MAKE-UP MECHAN | | | SMS | | |
| Individual written and/or oral tests or individual coding/programming tests | 40% | Observation (technical | I capacity, a | ttitude and part | icipation) |
| 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. | | | | | |
| CH - Class hours: 8 h. NCH - Non-class hours: 5,5 h. TH - Total hours: 13,5 h. | | | | | |

RMM124 [!] Seleccionar las técnicas de segmentación y extracción de características idóneas para el diagnóstico de imágenes biomédicas.

| LEARNING ACTIVITIES | СН | NCH | ТН | | |
|--|----------|---|-------|--------|--------|
| Conducting tests, giving presentations, presenting defence checkpoints | 4 h. | 2 h. | 6 h. | | |
| Carrying out/resolving projects/challenges/cases, etc. to pr interdisciplinary contexts, real and/or simulated, individually | 10 h. | 6 h. | 16 h. | | |
| Carrying out exercises and solving problems individually and/or in teams | | | | 3,5 h. | 8,5 h. |
| EVALUATION SYSTEM | W | MAKE-UP MECHANISM | IS | | |
| Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems | 70% | Individual written and/or oral tests or individual coding/programming tests Comments: If the score of the exam is lower than 5. it W | | | |
| Individual written and/or oral tests or individual coding/programming tests | 30% | mandatory to repeat the e | xam | | · |
| Comments: If the score of the exam is lower than 4, this valuation item will be evaluated in its entirety (%100) with the f the exam. | he score | | | | |
| CH - Class hours: 19 h. NCH - Non-class hours: 11,5 h. IH - Total hours: 30 5 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 | | | СН | NCH | тн | | |
|---|-----|------------------------|---------------|----------------|------------|--|--|
| 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 MAKE-UP MECHAI | | | ISMS | | | | |
| Individual written and/or oral tests or individual coding/programming tests | 40% | Observation (technical | capacity, att | itude and part | icipation) | | |
| Co-assessment | 5% | | | | | | |
| Prototype / Product | 55% | | | | | | |
| Comments: If the score of the defense is lower than 5 evaluation item will be evaluated in its entirety (%100) v of the defense. A co-evaluation system will be impleme adjust the score of the student based on his or her partitive the Project. | | | | | | | |
| CH - Class hours: 8,5 h. NCH - Non-class hours: 5 h. TH - Total hours: 13,5 h. | | | | | | | |

| RMM123 [!] Dominar las técnicas de mejora digital de las imágenes biomédicas necesar | ias para su p | oost-procesad | do. |
|---|---------------|---------------|--------|
| LEARNING ACTIVITIES | СН | NCH | ТН |
| 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 | 4,5 h. | 3,5 h. | 8 h. |
| Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints | 2 h. | 1 h. | 3 h. |
| Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects | 5 h. | 2,5 h. | 7,5 h. |



Goi Eskola Politeknikoa | Mondragon Unibertsitatea

Course: 2024 / 2025 - Course planning

| EVALUATION SYSTEM | 14/ | |
|--|----------|---|
| EVALUATION STSTEM | | |
| Presentation and defence of exercises, case studies, | 70% | Individual written and/or oral tests or individual |
| loboratory practical work, simulation practical work, | | O and the second of the second is leaven the second the second se |
| project, master's thesis, challenges and problems | | Comments: If the score of the exam is lower than 5, it Will be mandatory to repeat the exam |
| Individual written and/or oral tests or individual coding/programming tests | 30% | |
| Comments: If the score of the exam is lower than 4, this | | |
| evaluation item will be evaluated in its entirety (%100) with the | he score | |
| of the exam | 10 00010 | |
| | | |
| CH - Class hours: 115 h | | |
| NCH Non aloos hours, 7 h | | |
| THE Tatal have 40.5 h | | |
| IH - IOTAI NOURS: 18,5 N. | | |
| | | |

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 | | | СН | NCH | ТН | | | | |
|---|-----|------------------------|---------------|----------------|------------|---|--|--|--|
| 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 | | | | 1,3 h. | 3,5 h. | - | | | |
| EVALUATION SYSTEM W MAKE-UP MECHAN | | | | ISMS | | | | | |
| Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems | 50% | Observation (technical | capacity, att | itude and part | icipation) | - | | | |
| 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% | | | | | | | | |
| CH - Class hours: 2,2 h. NCH - Non-class hours: 1,3 h. TH - Total hours: 3,5 h. | | | | | | | | | |

CONTENTS

- 1. Morphological processing
- 1.1 Erosion and dilation
- 1.2 Opening and closing
- 1.3 Hit and Miss
- 1.4 Complex morphological operations
- 1.5 Grayscale morphological operations
- 2. Image segmentation
- 2.1 Point, line and border detection
- 2.2 Gradients and Laplacians
- 2.3. Canny
- 2.4. Contour following
- 3.- Image restoration and reconstruction
- 4.- Complex practice with real images



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Learning resources Bibliography Technical articles Bankman, I. N., & Morcovescu, S. (2002). Handbook of Medical Imaging. Processing and Analysis. Medical Physics Noodle Platform Class presentations Prince, J. L., & Links, J. M. (2006). Medical imaging signals and systems. Pearson Prentice Hall

Rangayyan, R. M. (2004). Biomedical image analysis. CRC press. Gonzalez, R.C., & Woods, R.E. (2008). Digital Image Processing. Pearson Prentice Hall

Gonzalez, R.C., Woods, R.E., Eddins, S.L. (2009). Digital Image Processing Using MATLAB. Gatesmark Publishing