

## [MHD201] METAL AND REINFORCED CONCRETE STRUCTURES

### GENERAL INFORMATION

|                  |   |  |  |
|------------------|---|--|--|
| <b>Studies</b>   | UNIVERSITY MASTER IN INDUSTRIAL ENGINEERING | <b>Subject</b>                           | ?  |
| <b>Semester</b>  | 1   | <b>Course</b>                            | 1  |
| <b>Character</b> | COMPULSORY                                  | <b>Mention / Field of specialisation</b> |  |
| <b>Plan</b>      | 2022  | <b>Modality</b>                          | Face-to-face   |
| <b>Credits</b>   | 6   | <b>Hours/week</b>                        | 3.61   |
|                  |   | <b>Language</b>                          | CASTELLANO   |
|                  |   | <b>Total hours</b>                       | 65 class hours + 85 non-class hours = <b>150 total hours</b> |

### PROFESSORS

|                           |
|---------------------------|
| AIZPURU NAZABAL, AITZIBER |
| GOMENDIO RUIZ, AMAIA      |
| IRIONDO GABILONDO, JAIONE |
| ELKORO UGARTEBURU, ANDER  |
| VIDAL EZQUERRA, IKER      |

### REQUIRED PREVIOUS KNOWLEDGE

| Subjects                                      | Knowledge                        |
|---|----------------------------------|
| MATERIAL ELASTICITY AND STRENGTH              | (No previous knowledge required) |
| INDUSTRIAL STRUCTURAL AND CONSTRUCTION THEORY |                                  |

### LEARNING RESULTS

| LEARNING RESULTS   | KC | SK | AB | ECTS     |
|--|----|----|----|----------|
| <b>MHRA17</b> - To demonstrate capacity for the design, construction and operation of industrial plants  |    | x  |    | 1,08     |
| <b>MHRA18</b> - To demonstrate knowledge about construction, building, facilities, infrastructure and urban planning in the field of industrial engineering  |    | x  |    | 0,36     |
| <b>MHRA19</b> - To demonstrate capacity for the management of technological Research, Development and Innovation   |    | x  |    | 2,88     |
| <b>MHRA23</b> - To demonstrate knowledge and capabilities to carry out certifications, audits, verifications, tests and reports  |    | x  |    | 0,48     |
| <b>MHRA27</b> - To demonstrate the ability to integrate knowledge and face the complexity of formulating judgments based on information that, being incomplete or limited, includes reflections on the social, health and safety, environmental, economic and industrial implications and responsibilities   |    | x  |    | 0,36     |
| <b>MHRA28</b> - 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  |    | 0,28     |
| <b>MHRA30</b> - To work with people, involving and directing them in a dynamic aimed at a common objective that includes reflection on their ethical and social responsibility, with a global vision of the work to be carried out and the characteristics that it requires (quality, deadlines,...), assuming responsibility for the decisions made |    | x  |    | 0,24     |
| <b>MHR126</b> - 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  |    | 0,08     |
| <b>MHR129</b> - To possess the learning skills that allow them to continue studying in a way that will be largely self-directed or autonomous  |    | x  |    | 0,24     |
| <b>Total:</b>  |    |    |    | <b>6</b> |

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

### ENAE LEARNING RESULTS

| ENAE LEARNING RESULTS   | ECTS |
|---|------|
| <b>ENA123</b> - Knowledge and comprehension: Deep knowledge and comprehension of mathematics and other basic sciences inherent in their engineering speciality, allowing them to achieve the other competencies of the degree.  | 0,6  |
| <b>ENA124</b> - Knowledge and comprehension: Deep knowledge and comprehension of the engineering disciplines of their speciality, at the level necessary to acquire the rest of the competencies of the degree.   | 0,5  |
| <b>ENA127</b> - Analysis in engineering: Ability to analyse new and complex engineering products, processes and systems within a broader multidisciplinary context; select and apply the most appropriate analysis, calculation and experimental methods already established, as well as innovative methods; and critically interpret the results of such analyses.   | 0,6  |
| <b>ENA128</b> - Analysis in engineering: Ability to conceive new products, processes, and systems.  | 0,7  |
| <b>ENA131</b> - Engineering projects: Ability to project, develop and design new complex products (parts, components, finished products, etc.), processes and systems with specifications defined incompletely and/or with conflicts, which require the integration of knowledge from different disciplines, and consider social, health and safety, environmental, economic and industrial aspects; to select and apply the appropriate methodologies or employ creativity to develop new project methodologies. | 0,5  |
| <b>ENA134</b> - Research and innovation: Ability to carry out bibliographic searches and consult and use databases and other information sources with discretion, in order to carry out simulations with the aim of conducting research on complex topics of their speciality.  | 0,5  |
| <b>ENA135</b> - Research and innovation: Ability to consult and apply codes of good practices and security in their speciality.   | 0,5  |
| <b>ENA136</b> - Research and innovation: High-level capacity and ability to project and carry out experimental investigations, interpret data with criteria, and draw conclusions.  | 0,5  |
| <b>ENA138</b> - Practical application of engineering: Complete knowledge of the applicable techniques and methods of analysis,  | 0,5  |

project and research, as well as their limitations.

|   |     |
|---|-----|
| <b>ENA141</b> - Practical application of engineering: Ability to apply standards of engineering practice.   | 0,5 |
| <b>ENA145</b> - Preparation of judgements: Ability to manage complex technical or professional activities or projects that require new approach approaches, assuming responsibility for the decisions made. | 0,6 |

**Total:** 6

### SECONDARY LEARNING RESULTS

**RMH103** [!] *Dimensiona y verifica tanto los elementos estructurales como las uniones de una estructura metálica cumpliendo los criterios de agotamiento descritos en la normativa vigente*

| 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.  |
| Personal study and flexible development of concepts and subjects using active dynamics, to foster more meaningful learning  |       | 7 h. | 7 h.  |
| Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints   |       | 2 h. | 2 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                                      |       | 5 h. | 5 h.  |
| Computer simulation exercises, individually and/or in teams   | 2 h.  | 3 h. | 5 h.  |
| Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects   | 15 h. |      | 15 h. |
| Carrying out exercises and solving problems individually and/or in teams  | 11 h. | 4 h. | 15 h. |
| Carrying out visits and/or learning trips to other university centres, laboratories, companies and/or thermal power plants  |       | 2 h. | 2 h.  |
| Tutoring sessions and monitoring of training activities   |       | 2 h. | 2 h.  |
| Reading and personal and/or shared analysis of relevant and current publications (books, articles, catalogues, etc.) related to the speciality  |       | 2 h. | 2 h.  |
| Self-assessment tests in a context of autonomous and continuous learning  | 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% | Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems   |
| 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 | 10% | 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 |
| Individual written and/or oral tests or individual coding/programming tests  | 70% | Individual written and/or oral tests or individual coding/programming tests  |

**CH - Class hours:** 30 h.  
**NCH - Non-class hours:** 30 h.  
**TH - Total hours:** 60 h.

**RMH104** [!] *Conoce el método de los estados límites y dimensiona o verifica las secciones y elementos estructurales de una estructura de hormigón armado incidiendo en la durabilidad de la estructura durante su vida en servicio*

| 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. |
| Personal study and flexible development of concepts and subjects using active dynamics, to foster more meaningful learning  |      | 7 h. | 7 h. |
| Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints   |      | 3 h. | 3 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                                      | 2 h. | 5 h. | 7 h. |

|  |          |                           |       |
|--|----------|---------------------------|-------|
| Computer simulation exercises, individually and/or in teams  | 2 h.     | 3 h.                      | 5 h.  |
| Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects  | 15 h.    |                           | 15 h. |
| Carrying out exercises and solving problems individually and/or in teams   | 11 h.    | 4 h.                      | 15 h. |
| Carrying out visits and/or learning trips to other university centres, laboratories, companies and/or thermal power plants   |          | 2 h.                      | 2 h.  |
| Tutoring sessions and monitoring of training activities  |          | 2 h.                      | 2 h.  |
| Reading and personal and/or shared analysis of relevant and current publications (books, articles, catalogues, etc.) related to the speciality   |          | 2 h.                      | 2 h.  |
| <b>EVALUATION SYSTEM</b>   | <b>W</b> | <b>MAKE-UP MECHANISMS</b> |       |
| Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems   | 10%      | <i>(No mechanisms)</i>    |       |
| 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 | 20%      |                           |       |
| Individual written and/or oral tests or individual coding/programming tests  | 70%      |                           |       |
| <b>CH - Class hours:</b> 30 h.   |          |                           |       |
| <b>NCH - Non-class hours:</b> 30 h.  |          |                           |       |
| <b>TH - Total hours:</b> 60 h.   |          |                           |       |

|  |           |  |           |
|--|-----------|--|-----------|
| <b>RMH105 [1] Diseña y proyecta una estructura metálica y/o de hormigón armado con apoyo de programas informáticos específicos</b>   |           |  |           |
| <b>LEARNING ACTIVITIES</b>   | <b>CH</b> | <b>NCH</b>   | <b>TH</b> |
| 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.      |
| Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints  | 1 h.      |  | 1 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   | 2 h.      | 8 h.   | 10 h.     |
| Computer simulation exercises, individually and/or in teams  | 2 h.      | 8 h.   | 10 h.     |
| Carrying out visits and/or learning trips to other university centres, laboratories, companies and/or thermal power plants   |           | 1 h.   | 1 h.      |
| Tutoring sessions and monitoring of training activities  |           | 1 h.   | 1 h.      |
| Reading and personal and/or shared analysis of relevant and current publications (books, articles, catalogues, etc.) related to the speciality   |           | 1 h.   | 1 h.      |
| <b>EVALUATION SYSTEM</b>   | <b>W</b>  | <b>MAKE-UP MECHANISMS</b>  |           |
| Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems   | 60%       | Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems   |           |
| 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 | 40%       | 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 |           |
| <b>CH - Class hours:</b> 5 h.  |           |  |           |
| <b>NCH - Non-class hours:</b> 25 h.  |           |  |           |
| <b>TH - Total hours:</b> 30 h.   |           |  |           |

## CONTENTS

## LEARNING RESOURCES AND BIBLIOGRAPHY

### Learning resources

Subject notes

[!] *Programas de Simulación (CYPE)*

Presentations by external Lecturers

Topic related web quires

Video projections

Computer practical training

[!] *Visita a edificios/obras*

[!]

[http://katalogoa.mondragon.edu/janium-bin/janium\\_login\\_opac\\_re\\_Ink.pl?grupo=INGINDUSTRIAL11&ejecuta=20](http://katalogoa.mondragon.edu/janium-bin/janium_login_opac_re_Ink.pl?grupo=INGINDUSTRIAL11&ejecuta=20)

Moodle Platform

[!]

<https://www.mitma.gob.es/organos-colegiados/comision-permanente-de-estructuras-de-acero/cpa/codigo-estructural>

### Bibliography

A. Hirt MA, Crisinel M. Charpentes Métalliques. Presses polytechniques et universitaires romandes; 2005

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Ministerio de Fomento. Código Técnico de la Edificación. Servicio de publicaciones del Ministerio de Fomento, 2010

Argüelles Alvares R, Arriaga Martitegui F, Argüelles Bustillo JM, Atienza. Estructuras de Acero. Tomo I: Cálculo, Norma Básica y Eurocódigo, 3ª edición. Editorial Bellisco; 2013

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