

## [MHG201] FINITE ELEMENTS IN STRUCTURAL MECHANICS

### GENERAL INFORMATION

<b>Studies</b>	UNIVERSITY MASTER IN INDUSTRIAL ENGINEERING	<b>Subject</b>	?
<b>Semester</b>	1	<b>Course</b>	1
<b>Character</b>	OPTIONAL	<b>Mention / Field of specialisation</b>	???
<b>Plan</b>	2022	<b>Modality</b>	Face-to-face
<b>Credits</b>	3	<b>Hours/week</b>	1.83
		<b>Language</b>	ENGLISH
		<b>Total hours</b>	33 class hours + 42 non-class hours = <b>75 total hours</b>

### PROFESSORS

TORCA DE LA CONCEPCIÓN, IRENEO

### REQUIRED PREVIOUS KNOWLEDGE

Subjects	Knowledge
(No specific previous subjects required)	Fundamentals of mathematics
	Fundamentals of physics
	Theory of machines and mechanisms
	Elasticity and strength of materials
	Mechanical design

### LEARNING RESULTS

LEARNING RESULTS	KC	SK	AB	ECTS
<b>MHME01</b> - To design and carry out machine tests considering the mechanical behavior of the material		x		0,8
<b>MHME04</b> - To demonstrate knowledge and capabilities for the calculation and design of structures using finite elements		x		1,6
<b>MHRA22</b> - To demonstrate knowledge and capabilities to carry out verification and control of facilities, processes and products			x	0,08
<b>MHRA23</b> - To demonstrate knowledge and capabilities to carry out certifications, audits, verifications, tests and reports			x	0,12
<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	0,08
<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	0,12
<b>MHR125</b> - To possess and understand knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context			x	0,08
<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	0,04
<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	0,08

**Total:** 3

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

### ENAE LEARNING RESULTS

ENAE LEARNING RESULTS	ECTS
<b>ENA125</b> - Knowledge and comprehension: Critical Possession of avant-garde knowledge of their speciality.	0,33
<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.	0,33
<b>ENA128</b> - Analysis in engineering: Ability to conceive new products, processes, and systems.	0,33
<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.	0,33
<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.	0,33
<b>ENA138</b> - Practical application of engineering: Complete knowledge of the applicable techniques and methods of analysis, project and research, as well as their limitations.	0,33
<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.	0,33
<b>ENA146</b> - Communication and Teamwork: Ability to employ different methods to communicate their conclusions, clearly and unambiguously, and the knowledge and logical foundations that support them, to audiences specialised and not specialised in the issue, in domestic and international contexts.	0,33
<b>ENA147</b> - Communication and Teamwork: Ability to operate effectively in domestic contexts as a member or leader of a team, which may be composed of people of different disciplines and levels, and who can use virtual communication tools.	0,33

## SECONDARY LEARNING RESULTS

**RMH156** [!] *Elabora modelos estructurales complejos y de procesos mediante elementos finitos acorde con sus características, efectúa las simulaciones y analiza sus resultados*

LEARNING ACTIVITIES	CH	NCH	TH
Personal study and flexible development of concepts and subjects using active dynamics, to foster more meaningful learning		20 h.	20 h.
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	3 h.		3 h.
Computer simulation exercises, individually and/or in teams	10 h.	22 h.	32 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	20 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	20%	Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems
Individual written and/or oral tests or individual coding/programming tests	80%	Individual written and/or oral tests or individual coding/programming tests
		<b>Comments:</b> All activities (control points, individual and group assignments, etc...) must have a minimum mark (5 minimum) and there will be an opportunity to retake every activity. In case of retake of the control point, the final mark will be the mark of the retake. Failed assignments, practices, etc... must be retaken and will be graded with a maximum mark of 5.

**CH - Class hours:** 33 h.  
**NCH - Non-class hours:** 42 h.  
**TH - Total hours:** 75 h.

## CONTENTS

1. Fundamentals
2. Discretization
3. Materials
4. Interactions & Constraints
5. Loads & Boundary Conditions
6. Solver
7. Postprocessing
8. Other problems

## LEARNING RESOURCES AND BIBLIOGRAPHY

Learning resources	Bibliography
Slides of the subject	Oñate, E. (2009). Structural Analysis with the Finite Element Method. Linear Statics. Volume 1. Basis and Solids. CIMNE.
Moodle Platform	Chandrupatla, T. R. et al. (2012). Introduction to finite elements in engineering. Pearson Education.
Specific Master Software	Zienkiewicz, O. C. and Taylor, R. L. (1995). El método de los elementos finitos. Vol 1. McGraw Hill.
Computer practical training	Liu, G. R. and Quek, S. (2003). Finite element method. A practical course. Butterworth-Heinemann.