



Universitat de Lleida

DEGREE CURRICULUM  
**DESIGN OF METAL  
STRUCTURES**

Coordination: LAMPURLANÉS CASTEL, JORGE

Academic year 2021-22

## Subject's general information

<b>Subject name</b>	DESIGN OF METAL STRUCTURES			
<b>Code</b>	14539			
<b>Semester</b>	2nd Q(SEMESTER) CONTINUED EVALUATION			
<b>Typology</b>	<b>Degree</b>	<b>Course</b>	<b>Character</b>	<b>Modality</b>
	Master's Degree in Industrial Engineering (M 2021)	2	OPTIONAL	Attendance-based
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<b>Course number of credits (ECTS)</b>	6			
<b>Type of activity, credits, and groups</b>	<b>Activity type</b>	PRAULA		TEORIA
	<b>Number of credits</b>	3		3
	<b>Number of groups</b>	1		1
<b>Coordination</b>	LAMPURLANÉS CASTEL, JORGE			
<b>Department</b>	AGRICULTURAL AND FOREST ENGINEERING			
<b>Teaching load distribution between lectures and independent student work</b>	60 h face to face. 90 h independent student work.			
<b>Important information on data processing</b>	Consult <a href="#">this link</a> for more information.			
<b>Language</b>	English			

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
LAMPURLANÉS CASTEL, JORGE	jorge.lampurlanes@udl.cat	6	

## Subject's extra information

Construccions Industrials II és una matèria optativa que es cursa en el primer semestre del segon curs. Amplia els continguts de construcció que es veuen a la materia Construccions Industrials I sobre estructures d'acer.

Corequisits: CONSTRUCCIONS INDUSTRIALS I

## Learning objectives

- To determine the actions that must support a structure.
- To generate the decisive combinations of actions.
- To get the critical stresses for the sizing of the structure
- To know the properties of structural steel and the commercial profiles.
- To determine the section properties and classify it.
- To get the strength capacity of a section
- To size a steel structural member according to its stresses.
- To size a steel structure using specific commercial software.
- To check the sizing performed with commercial software using its own tools.
- To propose alternatives to the design of a structure for an industrial building and to choose the most convenient.
- To write a technical report on a steel frame.
- To express themselves correctly using appropriate technical vocabulary.
- To use technical information written in other languages.

## Competences

Degree-specific competences:

- Knowledge of construction, building, facilities, infrastructures and town planning in the field of industrial engineering.
- Ability to design, build and exploit industrial plants.
- Knowledge and ability for structural calculus and design.

Degree-transversal competences:

- Ability to transmit information, ideas, problems and solutions to specialized and nonspecialized audiences.
- Ability to conceive, design and deploy projects and/ or contribute new solutions, using engineering tools.

University of Lleida strategic competences:

- Correctness in oral and written language.
- Master a foreign language.

## Subject contents

1. Design to the Eurocodes.
2. Actions to the Eurocodes.
3. Structural typology: Single and multistory buildings, industrial steelworks.
4. Global analysis of the structure: Imperfections. Linear and non-linear behavior. Dynamic analysis (earthquakes, vibrations).
5. Failure processes: design to avoid fragile breakage, fatigue.
6. Design of elements: section classification, plate girders, trusses, light gauge steel elements.
7. Connections design: Bolted and welded joints, simple and moment connections, column bases.
8. Fire protection and fire engineering.
9. Building envelope: Roof and walls.
10. Construction: Expansion joints, fabrication, corrosion prevention, assembly.

## Methodology

Next teaching methodologies will be used:

- Lectures: The contents of the subjects are exposed orally by a teacher without the active participation of students.
- Problem solving: Applying the theory to solve specific situations.
- Reading: The legal texts related to the subjects.
- Teamwork: Learning activity that should be done through collaboration between members of a group.
- Problem Based learning: Problem-based learning is used as a method of promoting learning from selected problems of real life.
- Visit: activity of a group of students, led by teachers, which consist of going to see a certain place to get actual information to favor the learning process.

During the **class sessions** what is wanted to be achieved is the active participation of the students so that each class would be an enriching experience (**Active class**). To achieve this, various methods are used before, during and after the class:

- Before the class (**Reversed class**):
  - To read the rules related to the topic to be developed during that week.
  - A questionnaire on the reading conducted to detect the points not been understood. There will be a classification of students based on the number of questions answered correctly (**Gamification**).
- During the class:
  - Explanation of the topic with particular emphasis on especially difficult aspects, according to the results of the questionnaire.
  - To ask questions and give students time to: think about them individually, discuss them with the neighbor (peer instruction), and discuss them with the class.
  - Resolution of exercises in class by splitting them in different sections to be solved by groups of students.
- After the class:
  - Solved and unsolved exercises would be available for self-evaluation.

To enhance **teamwork** of the students, **project-based learning** would be used. The students must organize in teams and project a structure for an industrial facility. This will allow them to apply the course contents in a real context.

## Development plan

Week	Methodology	Topics	Face-to-face hours	Autonomous work hours
1	Active class Problem solving	Introduction. Class project. 1. Design to the Eurocodes. 2. Actions to the Eurocodes.	4	6
2, 3	Active class Problem solving	2. Actions to the Eurocodes.	8	12
4, 5	Active class Problem solving	3. Structural typology. 4. Global analysis of the structure.	8	12
6, 7	Active class Problem solving	5. Failure processes. 6. Design of elements:	8	12
8	Visit	Metal structures factories.	4	6
9	Assessment: exam	1st term	3	
10, 11, 12	Active class Problem solving	7. Connections design.	12	18
13, 14	Active class Problem solving	8. Fire protection and fire engineering.	8	12
15	Active class Problem solving	9. Building envelope: Roof and walls. 10. Construction: Expansion joints, fabrication, corrosion prevention, assembly.	4	6
16	Assessment: exam	2nd term	3	
17, 18, 19	Assessment: exam	Resit	3-6	

## Evaluation

- 50% 1st class project.
- 50% 2nd class project.

## Bibliography

### Recommended bibliography

#### Codes:

- Eurocode Standards: <https://law.resource.org/pub/eu/eurocode.html>
- Eurocodi (AENOR, UNE-EN): EC0 (1990), EC1 (1991), EC3 (1993) (Biblioteca / Bases de dades / NORMWEB) i annex nacional ([www.fomento.gob.es](http://www.fomento.gob.es)).

#### Basic references:

- Steel buildings in Europe:

[https://constructalia.arcelormittal.com/en/news\\_center/articles/design\\_guides\\_steel\\_buildings\\_in\\_europe](https://constructalia.arcelormittal.com/en/news_center/articles/design_guides_steel_buildings_in_europe)

## Additional references:

- Argüelles. 2013. Estructuras de acero 1: Cálculo (3ª edición). Ed. Bellisco.
- Argüelles. 2013. Estructuras de acero 2: Uniones y sistemas estructurales (2ª edición). Ed. Bellisco.
- Arnedo. 2009. Naves industriales con acero. APTA.
- Monfort. 2006. Estructuras metálicas para edificación. Adaptado al CTE. Ed. UPV.
- Monfort. 2008. Problemas de estructuras metálicas adaptados al Código Técnico. Ed. UPV.
- ENSIDESA. 1990. Prontuario ENSIDESA.
- Davidson & Owens. 2012. Steel Designers Manual 7<sup>th</sup> edition. Wiley-Blackwell.

## Websites:

- Cátedra acero: [catedracero.ee.upm.es](http://catedracero.ee.upm.es)
- Asociación para la Promoción Técnica del Acero (APTA): [apta.com.es/index.php](http://apta.com.es/index.php)
- Acces Steel: [www.access-steel.com](http://www.access-steel.com)
- Constructalia: [www.constructalia.com](http://www.constructalia.com)