DEGREE CURRICULUM

DESIGN OF METAL STRUCTURES

Coordination: LAMPURLANES CASTEL, JORGE

Academic year 2023-24

DESIGN OF METAL STRUCTURES 2023-24

Subject's general information

<table>
<tr><td>Subject name</td><td>DESIGN OF METAL STRUCTURES</td></tr>
<tr><td>Code</td><td>14539</td></tr>
<tr><td>Semester</td><td>2nd Q(SEMESTER) CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td>
<table>
<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Master's Degree in Industrial Engineering</td><td>2</td><td>OPTIONAL</td><td>Attendance-based</td></tr>
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<tr><td>Course number of credits (ECTS)</td><td>6</td></tr>
<tr><td>Type of activity, credits, and groups</td><td>
<table>
<tr><th>Activity type</th><th>PRAULA</th><th>TEORIA</th></tr>
<tr><td>Number of credits</td><td>3</td><td>3</td></tr>
<tr><td>Number of groups</td><td>1</td><td>1</td></tr>
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<tr><td>Coordination</td><td>LAMPURLANES CASTEL, JORGE</td></tr>
<tr><td>Department</td><td>AGRICULTURAL AND FOREST SCIENCES AND ENGINEERING</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>60 h face to face.
90 h independent student work.</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Language</td><td>English.</td></tr>
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Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
COTS CALL, JOSEP MARIA	josepmaria.cots@udl.cat	5	
LAMPURLANES CASTEL, JORGE	jorge.lampurlanes@udl.cat	1	

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.

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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

- 25% 1st & 2nd assignments.
- 25% 3rd & 4th assignments.
- 25% 5th & 6th assignments.
- 25% 7th & 8th assignments.

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).

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Basic references:

- 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 7th edition. Wiley-Blackwell.

Websites:

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