Universitat de Lleida

DEGREE CURRICULUM

DESIGN OF METAL STRUCTURES

Coordination: LAMPURLANÉS CASTEL, JORGE

Academic year 2019-20

Subject's general information

Subject name	DESIGN OF METAL STRUCTURES
Code	14539
Semester	2nd Q(SEMESTER) CONTINUED EVALUATION
Typology	<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></table>
Course number of credits (ECTS)	6
Type of activity, credits, and groups	<table><tr><th>Activity type</th><th>PRAULA</th><th>TEORIA</th></tr><tr><th>Number of credits</th><td>3</td><td>3</td></tr><tr><th>Number of groups</th><td>1</td><td>1</td></tr></table>
Coordination	LAMPURLANÉS CASTEL, JORGE
Department	AGRICULTURAL AND FOREST ENGINEERING
Teaching load distribution between lectures and independent student work	60 h face to face. 90 h independent student work.
Important information on data processing	Consult this link for more information.
Language	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

- 20% 1st term exam.
- 20% 2nd term exam.
- 30% class project.
- 30% specialization's project.

Bibliography

Recommended bibliography

Codes:

Eurocodi (AENOR, UNE-EN): EC0 (1990), EC1 (1991), EC3 (1993)

(Biblioteca / Bases de dades / NORMWEB) i annex nacional (www.fomento.gob.es).

Documents Bàsics del CTE: DB SE, DB SE-AE, DB SE-A (www.codigotecnico.org).

Instrucció de l'Acer Estructural: EAE (www.fomento.gob.es).

Basic references:

Monfort. 2006. Estructuras metálicas para edificación. Adaptado al CTE. Ed. UPV.

Arnedo. 2009. Naves industriales con acero. APTA.

Additional references:

Argüelles. 2005. Estructuras de acero. Cálculo. Ed. Bellisco.

Argüelles. 2007. Estructuras de acero. Uniones y sistemas estructurales. Ed. Bellisco.

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

Adaptations to the evaluation due to COVID-19

Items to be evaluated and its weight in the final mark:

- Assessments: 10%
- 1st coursework: 45%
- 2nd coursework: 45%