Universitat de Lleida

DEGREE CURRICULUM

INDUSTRIAL STRUCTURES I

Coordination: LAMPURLANÉS CASTEL, JORGE

Academic year 2019-20

Subject's general information

<table>
<tr><td>Subject name</td><td>INDUSTRIAL STRUCTURES I</td></tr>
<tr><td>Code</td><td>14528</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>1</td><td>COMPULSORY</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><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>
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<tr><td>Coordination</td><td>LAMPURLANÉS CASTEL, JORGE</td></tr>
<tr><td>Department</td><td>AGRICULTURAL AND FOREST ENGINEERING</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>6 ECTS x 25 h/ECTS = 150 h

40% face-to-face ==> 60 h
60% independent work ==> 90 h</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Language</td><td>Catalan and Spanish</td></tr>
<tr><td>Office and hour of attention</td><td>Send an email to arrange a meeting</td></tr>
</table>

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

"Industrial Structures I" belongs to Module II: "Facilities, plants and complementary constructions". It addresses the foundations of calculation and sizing of steel and reinforced concrete structures for industrial facilities, according to the current construction codes. These contents are complemented and expanded in "Design and calculus of steel structures", elective subject from the 2nd year.

Advice:
We advise you to refresh your knowledge on Strength of Materials and Structural Analysis for a better understanding of the subject.

IMPORTANT NOTICE:

It is **COMPULSORY** that the students bring the following elements of individual protection (EPI) to the practices at the laboratory.

- Laboratory gown from UdL (unisex)
- Protection glasses
- Mechanical protection gloves

They can be purchased through the shop Údels of the UdL:

C/ Jaume II, 67 baixos
Centre the Cultures i Cooperació Transfronterera

http://www.publicacions.udl.cat/

The use of other elements of protection (for example caps, masks, gloves of chemical or electrical risk, etc.) will depend on the type of practice to be done. In that case, the teacher will inform of the necessity of specific EPI.

Not bringing the EPI's described or not fulfilling the norms of general security that are detailed below imply that the student can not access to the laboratories or have to go out of them. The no realization of the practices for this reason imply the **consequences in the evaluation** of the subject that are described in this course guide.

GENERAL NORMS OF SECURITY IN LABORATORY PRACTICES

- Keep the place of realisation of the practices clean and tidy. The table of work has to be free from backpacks, folders, coats...
- No short trousers or short skirts are allowed in the laboratory.
- Closed and covered footwear is compulsory in the laboratory.
- Long hair needs to be tied.
- Keep the laboratory gown laced in order to be protected from spills of chemicals.
- Bangles, pendants or wide sleeves are not allowed as they can be trapped.
- Avoid the use of contact lenses, since the effect of the chemical products is much bigger if they enter between the contact lenses and the cornea. Protection over-glasses can be purchased.
- No food or drink is allowed in the laboratory.

- It is forbidden to smoke in the laboratories.
- Wash your hands whenever you have contact with a chemical product and before going out of the laboratory.
- Follow the instructions of the teacher and of the laboratory technicians and ask for any doubt on security.
- For further information, you can check the following document of the *Servei de Prevenció de Riscos Laborals de la UdL*: http://www.sprl.udl.cat/alumnes/index.html

Learning objectives

GENERAL PURPOSE OF THE SUBJECT

Provide students with the **knowledge** and **techniques**, **tools**, **skills** and **abilities** needed to effectively **direct** and **administer** the **construction** of and industrial facility, both phases: **design** and **implementation**.

The achievement of this overall objective is summarised as:

- **Start student orientation** towards the design and selection of the best solution to every construction problem that confronts, supported by a methodology.
- **Develop and conduct design** of building elements, at a basic level.
- **To know the different options** which require the implementation of an engineering project through a good understanding of the basic building blocks.
- **The technical capacity** to formulate projects in engineering, and their planning and program.
- **Establish solid bases** in the subjects treated, because if the fundamentals have been assimilated properly, the student will have greatly facilitated the development of their careers**.**

Competences

Basic competences set in Royal decree 861/2010 and Order CIN/311/2009:

- CB2 To be able to apply the knowledge gained and to solve problems in new environments in wider contexts (or multidisciplinary) related with the area of study.

General competences set in ORDEN CIN/311/2009 and EPS criteria:

- CG1 Capacity of planning and organizing the personal work.
- CG4 Capacity to conceive, design and implement projects and/or provide new solutions, using the tools that the engineering offers.
- CG5 To be motivated for the quality and the steady improvement.
- CG6 To have suitable knowledge of the scientific and technological issues of: mathematical, analytical and numerical methods in engineering, electrical engineering, energetic engineering, chemical engineering, mechanical engineering, mechanics of continuous means, industrial electronics, automation, manufacture, material, quantitative methods of management, industrial computing, urbanism, infrastructures, etc.
- CG7 To project, calculate and design products, processes, installations and plants.
- CG9 To do research, development and innovation in products, processes and methods.

Specific competences set in ORDEN CIN/311/2009:

- CE9 Capacity for the design, construction and exploitation of industrial plants.
- CE10 Knowledge on construction, building, installations, infrastructures and urbanism in the field of the industrial engineering.
- CE11 Knowledge and capacities for the calculation and design of structures.
- CE13 Knowledge on methods and techniques of transportation and industrial maintenance services.

Cross-disciplinary competences approved by the Plenary Commission of the Degrees of Industrial Engineering, Computer Engineering and Building Engineering, gathered in June 16th, 2008:

- CT3 Mastering ICT's.

Subject contents

Theoretical contents:

Lesson 1. Introduction.

1.1. Industrial warehouses: Structural typology.
1.2. Project of building structures.
1.3. Qualitative structural analysis.
1.4. Approximate structural analysis.
1.5. Actions and their combination.

Lesson 2. Steel structures.

2.1. Industrial warehouses of steel structure.
2.2. The steel as a construction material.
2.2. Sizing of steel bars.

Lesson 3. Structures of reinforced concrete.

3.1. Concrete, reinforcements and durability.
3.2. Beams and columns.
3.3. Unidirectional slabs.
3.4. Shallow foundations.
3.5. Retaining walls.

Practical contents:

- Commercial software to design steel and reinforced concrete structures.
- Preparation of concrete specimens.
- Determination of the characteristic strength of the concrete.

Site visits:

- Concrete manufacturing plant.
- Factory of cold formed profiles.
- Factory of metal structures.

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.
- Practice: Enables implement and configure, in practice, the theory of a field of knowledge in a specific context.
- Visit: activity of a group of students, led by teachers, which consist of going to see a certain place to get actual information to favour 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 neighbour (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. 1.1. Industrial warehouses: Structural typology 1.2. Project of building structures.	4	6
2	Active class Problem solving Practices	1.3. Qualitative analysis of structures.	4	6
3	Active class Problem solving	1.4. Approximate analysis of structures.	4	6
4, 5	Active class Problem solving	1.5. Actions and their combination.	8	12
6, 7	Active class Problem solving	2.1. Industrial warehouses of steel structure. 2.2. Steel as a construction material. 2.3. Sizing of steel bars.	8	12
8	Visit	Concrete and metal structures factories.	4	6
9	Assessment: exam	1st term	3	
10	Active class Problem solving Practices	3.1. Concrete, reinforcements and durability. Concrete dosage	4	6
11	Active class Problem solving	3.2. Beams and columns.	4	6
12	Active class Problem solving	3.3. Unidirectional slabs.	4	6
13	Active class Problem solving	3.4. Shallow foundations.	4	6

14	Practices	Computer sizing of reinforced concrete structures. Determination of the characteristic concrete strength	4	6
15	Active class Problem solving	3.5. Retaining walls.	4	6
16	Assessment: exam	2nd term	3	
17, 18, 19	Assessment: exam	Resit	3-6	

Evaluation

Goals	Assessment activities	Criteria[1]	%	Date	C/NC [2]	I/T [3]	Remarks
Lessons 1 & 2	Questionnaires Exam [4] Class project: industrial hall	Mark ≥ 5 Mark ≥ 5	0 35 15	Every week Week 9 Week 9	V O O	I I G	The access to the questionnaires will close at the designed date 2 person teams.
Lesson 3	Questionnaires Exam [4] Class project: building	Mark ≥ 5 Mark ≥ 5	0 35 15	Every week Week 16 Week 16	V O O	I I G	The access to the questionnaires will close at the designed date 2 person teams.
Retest	Exam [4]	Mark ≥ 5	35-70 [5]	Week 19	O [6]	I	

[1] The minimum mark to average is 5, even for exams and class projects. In the even of any part marked below 5, the global mark would be the mark of the part with lower mark.

[2] Compulsory / Not Compulsory.

[3] Individual / Team.

[4]The exam includes: Short answer questions (30%) + Problems with documentation (70%).

[5] Depending on the Lessons to retest.

[6] For those with parts marked below 5.

Bibliography

Basic references

- Ministerio de Fomento. Codigo Técnico de la Edificación (CTE). Avalaible at: <http://www.codigotecnico.org>
- Ministerio de Fomento. Instrucción del hormigón estructural (EHE-08).

Additional referencies

- ARGÜELLES, R. et al. 2013. Estructuras de Acero. Ed. Bellisco.
- GARCÍA MESEGUER, A., MORAN, F., 2010. Jiménez Montoya. Hormigón armado (15ª ed.). Ed. Gustavo Gili. Barcelona.

Other resources

The slides, practices and solved problems would be uploaded at **CAMPUS VIRTUAL**. Also, quizzes for self-assessment.

Adaptations to the evaluation due to COVID-19

The evaluation elements and their weight in the grade will be:

- Topics 1 and 2:
  - Online exam: 10%
  - Group work: 15%
  - Individual work: 25%
- Topic 3:
  - Online exam: 10%
  - Group work: 15%
  - Individual work: 25%