DEGREE CURRICULUM

THEORY OF STRUCTURES AND INDUSTRIAL CONSTRUCTION

Coordination: BRADINERAS ESCO, FRANCISCO JAVIER

Academic year 2020-21

THEORY OF STRUCTURES AND INDUSTRIAL CONSTR... 2020-21

Subject's general information

<table>
<tr><td>Subject name</td><td>THEORY OF STRUCTURES AND INDUSTRIAL CONSTRUCTION</td></tr>
<tr><td>Code</td><td>102307</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>Bachelor's Degree in Mechanical Engineering</td><td>3</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
<tr><td>Master's Degree in Industrial Engineering</td><td>1</td><td>COMPLEMENTARY TRAINING</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>2</td><td>1</td></tr>
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<tr><td>Coordination</td><td>BRADINERAS ESCO, FRANCISCO JAVIER</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>60h attendance class + 90h personal 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>Spanish</td></tr>
<tr><td>Distribution of credits</td><td>Francisco Javier Bradineras Esco 5
José Mª Iglesias Rodriguez 4</td></tr>
</table>

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
BRADINERAS ESCO, FRANCISCO JAVIER	javier.bradineras@udl.cat	5	
IGLESIAS RODRIGUEZ, JOSE M.	josemaria.iglesias@udl.cat	4	

Subject's extra information

Suggestions

Attendance and the resolution of the proposed problems is highly recommended. Case studies should be solved as soon as possible after its request. It is not advisable to leave work till last minute. See bibliography is a good support for the subject.

The course as part of the academic plan

Introduce new methods of structural design, including the matrix method and its adaptation to the calculation of second order, as required in the CTE. Give the students the basic knowledge and necessary information on construction technology so they have enough resources to schedule, manage and execute an industrial construction project with the help of other professionals. Provide the future engineer, criteria for choosing among the possible functional solutions, architectural and construtive, and also provide the technical criteria necessary to plan and manage the construction of a small industrial plant.

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

- Blue 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 realisation 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 laboratoy 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 lense 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

- Introduce new methods of structural analysis, including matrix stiffness method and its adaptation to the calculation of second order structures, as required by the CTE.

- Give to the students basic knowledge and the necessary data on building technology to have enough resources to plan, manage and implement a project of industrial building with the help of other professionals.

- Give to the future engineer knowledge enough to choose among the possible architectural and building solutions from a small manufacturing factory and also provide technical criterior necessary to plan and manage the building.

Competences

Degree-specific competences

- Knowledge and ability to apply the principles of elasticity and resistance of materials to the behaviour of real solids.

  Goals

  - Students must be able to address real problems and propose simplifications to them, within the field of strength of materials

- Knowledge and ability for calculus, structural design and industrial constructions.

  Goals

  - Students must be able to calculate a structure and decide what kind of links are the best to the design system selected

Degree-transversal competences

- Ability to gather and interpret relevant data in their field of study, and to emit judgements that include a reflection on relevant themes of a social, scientific or ethical nature

  Goals

  - Students must be able to interpret data of problems and results

- Ability to resolve problems and elaborate and defend arguments inside their field of study

  Goals

  - The student must learn to propose and decide the order to follow for solving problems and real cases

- Ability to analyse and synthesize.

  Goals

  - Students must be able to organize the results of the calculations and choose the relevant ones

Subject contents

1.- Calculation of reticulated structures.

1.1.- Analytical method

1.2.- Matrix method

2.- Industrial constructions.

2.1.- Industrial buildings. Design conditioning factors.

2.2.- Structural materials.

• 2.2.1. Steel

• 2.2.2.- Concrete

2.3.- Structural steel products

2.4.- Structural typology

2.5. Structural stability Bracing

2.6.- Construction of industrial buildings

2.7.- Unions

2.8.- Protection of structural steel

2.9.- Roofs of industrial buildings

2.10.- Lateral enclosures of industrial buildings

2.11.- Slabs in industrial buildings

2.12.- Floors in industrial buildings

2.13.- CTE Basic document SE-AE Actions in the building

2.14.- CTE Basic document of structural security DB-SE

Methodology

* Lectures: Before beginning with the problems a theoretical introduction to each chapter of the course will take place.

* Problems: The main focus of the course is to learn to solve problems of strength of materials and structural design. After the theoretical introduction will arise and solve different kind of problems. Problems are conducted in small groups.

* Exercises to deliver: Students also have to solve problems individually or in groups. The problems solved and delivered in class will be used in the calculation of the final mark for the subject. These exercises will be conducted in small groups.

* Case Studies: At the end of each chapter, a case studie will be required. Students will submit a final report with all of them. This case is different for each student as data depends on the student identification number. This report will also have an important weight in the mark of the subject.

Development plan

Week	Chapters	Classroom working hours	Freelance working hours
1-4	Capítol 1.1	14	21
5-8	Capítol 1.2	18	27
9	Capítol 2.1 - 2.2	4	6
10-11	Capítol 2.3 - 2.4	8	12
12-13	Capítol 2.5 - 2.6	8	12
14	Capítol 2.7 - 2.8 - 2.9 - 2.10 - 2.11 - 2.12	4	6
15	Capítol 2.12 - 2.14	4	6

Evaluation

Exams:80% (2 partials 40%)

Case Studie: 10% + 10% (Report and class exercises)

SUBJECT MARK (NA):

NE: Mark Structural calculation

NC: Mark Industrial building

If NE>=3 and NC>=3 NA = 0,5·NE+0,5·NC

If NE<3 or NC<3 NA = Min[(0,5·NE+0,5·NC) ; (3)]

Bibliography

* Cálculo Matricial de estructuras en 1er y 2do orden. Ramón Argüelles Álvarez

* Cálculo de estructuras. E.T.S.I.M. MADRID. Ramón Argüelles Álvarez

* Estructruas arquitectónicas e industriales, su cálculo. Enrique Nieto. ED. TEBAR.

* Teoría y cálculo sobre estructuras resistentes de prismas rectos. Santiago Rico Fernando. BELLISCO

* Curso de especialización en diseño de Naves Industriales. Análisis Matricial de estructuras de barras. José M. Iglesias.

Industrial Constructions

* **Naves industriales con acero. A. Arnedo Pena**. Publicaciones APTA

* **Estructuras metálicas para edificación. Adaptado al código técnico**. J. Monfort Lleonart et al. Editorial Universitat Politécnica de Valencia.

* **Manual de estructuras ilustrado ed. F.D.K. Ching**. Ed. Gustado Gili

* **CTE Código Técnico de la Edificación**

*** EAE Instrucción de Acero Estructural**

* **Programa CYPE (licencia estudiante UdL)**

* Estructuras de acero en edificación. C. Hurtado Mingo et al. Publicaciones APTA

* Problemas de estructuras metálicas adaptados al código técnico. J. Monfort Lleonart et al. Editorial Universidad Politécnica de Valencia.

* Principios de construcción de estructuras metálicas. D. Pellicer Daviña et al. Bellisco ediciones.

* Hormigón Armado Jiménez Montoya Esencial. J.C. Arroyo Portero. Ed. CINTER

* EHE-08 Instrucción de Hormigón Estructural