



Universitat de Lleida

# DEGREE CURRICULUM **STRUCTURES 3**

Coordination: CASTRO CHICOT, JOSE RAMON

Academic year 2022-23

## Subject's general information

<b>Subject name</b>	STRUCTURES 3			
<b>Code</b>	101418			
<b>Semester</b>	1st Q(SEMESTER) CONTINUED EVALUATION			
<b>Typology</b>	Degree	Course	Character	Modality
	Bachelor's Degree in Architectural Technology and Building Construction	3	COMPULSORY	Attendance-based
<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>	CASTRO CHICOT, JOSE RAMON			
<b>Department</b>	AGRICULTURAL AND FOREST ENGINEERING			
<b>Teaching load distribution between lectures and independent student work</b>	60 hours of attendance class plus 90 hours of autonomous work.			
<b>Important information on data processing</b>	Consult <a href="#">this link</a> for more information.			
<b>Language</b>	Català			

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
CASTRO CHICOT, JOSE RAMON	joseramon.castro@udl.cat	6	Sending an email to the teacher to carry out tutorials. Place: Building Laboratory 0.25. Ground floor CREA.

## Subject's extra information

The course includes the abstract problem of behavior of nodes and bars that define a portal building and their realization by supports, beams, floors, basement walls...in short, a reinforced concrete structure that can be calculated to be built.

Subject to be taken in the 1st semester of the 3rd year of teaching. It belongs to the module "Specific training", specifically in the field "Structure and facilities of the building."

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

- White laboratory gown from UdL (unisex)
- Protection glasses
- Mechanical protection gloves
- Security helmet
- Reflective vest
- **Safety footwear (\*)**

All these items, with the exception of the safety footwear, 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 safety footwear must be acquired by the student to any individual protection equipment provider, and must meet the requirements S1 + P (head and antforce template) according to what is established by EN ISO 20345**

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 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 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.spri.udl.cat/alumnes/index.html>

## Learning objectives

- Explain the most important chapters of the current instruction in mass, reinforced and prestressed concret Código Estructural (EC-2): Combinations load, ELU and ELS.
- Calculate and verify a composed bending and cutting a column of reinforced concrete.
- Calculate and verify a simple bending a beam of reinforced concrete.
- Calculate and verify a shear a beam of reinforced concrete.
- Calculate and verify a slab of reinforced concrete (unidirectional)
- Calculate and verify a slab of reinforced concrete (unidirectional, beams prestessed)
- Reinforce and drawing steel bars that form a frame of reinforced concrete.

## Competences

### Strategic competences of the University of Lleida

- **UdL 3.** Mastering TIC

### Degree-transversal competences

- **EP S7.** Ability to pan and organise the personal work.
- **EP S8.** Ability to work in situations where information is lacking or you are under pressure.

### Degree-specific competences according to ordre ECI/3855/2007

- **GEE21.** Ability to apply the technical rules to the building process and generate documents of technical specifications of the construction procedures and methods of the buildings.
- **GEE22.** Aptitude for the predimensioning, design, calculation and checking of structures and for the direction of their material execution.
- **GEE23.** Ability to constructively develop the installations of a building, control and plan their execution and verify the service and reception trials as well as those regarding maintainance.

## Subject contents

T1.-Introduction to Código Estructural (EC-2).

T2.-The mechanical properties of concrete and reinforcing steel.

T3.-The durability of the structure. ELU of durability.

T4.-Actions and combinations of actions in the building according to CTE-DB-AE and Código Estructural (EC-2).

T5.-Introduction to structural safety according to CTE-DB-SE and Código Estructural (EC-2).

T6.-Predimensioning of reinforced concrete frames.

T7.-Formwork in the building. The critical phase of the structure.

T8.-Calculus and vertical reinforced concrete structural elements according to Código Estructural: columns.

T9.-Calculus and horizontal reinforced concrete structural elements according to Código Estructural: beams and prestressed one-way slabs (unidirectional frameworks).

T10.-Instantaneous and delayed deflection in building. ELS.

T11.-Surface-foundation. Centered and eccentric footing. Centering beams.

T12.-Containment elements. Actions, analysis, dimensioning and assembly of reinforced concrete walls and basement cantilever according CTE-DB-C and Código Estructural.

## Methodology

**Master Class.** PowerPoint presentations and blackboard work to introduce matter of course.

**Exercices.** Planning and problem solving during the practice sessions. Labor board.

**Workgroup - practice.** Once explained the necessary material, students will form groups of two people, to develop their work. This work will be supervised by the teacher.

## Development plan

Week	Methodology	Temary	Classroom hours	Individual work hours
1	Master class	<b>T1.-</b> Introduction to Código Estructural (EC-2). <b>T2.-</b> The mechanical properties of concrete and reinforcing steel.	2 2	6
2	Master class	<b>T2.-</b> The mechanical properties of concrete and reinforcing steel. <b>T3.-</b> The durability of the structure. ELU of durability.	2 2	6

3	Master class	<b>T4.-</b> Actions and combinations of actions in the building according to CTE-DB-AE and DB-SE	2	6
	Exercises	<b>T4.-</b> Actions and combinations of actions in the building according to CTE-DB-AE and DB-SE.	2	
4	Master class	<b>T5.-</b> Introduction to structural safety according to CTE-DB-SE .	4	6
5	Master class	<b>T6.-</b> Predimensioning of reinforced concrete frames.	2	6
	Exercises	<b>T6.-</b> Predimensioning of reinforced concrete frames.	2	
6	Master class	<b>T7.-</b> -Formwork in the building. The critical phase of the structure.	2	6
	Master class	<b>T8.-</b> Calculus and vertical reinforced concrete structural elements according to Código Estructural: columns.	2	
7	Exercises	<b>T8.-</b> Calculus and vertical reinforced concrete structural elements according to Código Estructural: columns.	4	6
8	Master class	<b>T9.-</b> Calculus and horizontal reinforced concrete structural elements according to Código Estructural: beams and prestressed one-way slabs (unidirectional frameworks).	4	6
9	PA1. Written exam			
10	Exercises	<b>T9.-</b> Calculus and horizontal reinforced concrete structural elements according to Código Estructural: beams and prestressed one-way slabs (unidirectional frameworks).	4	6
11	Exercises	<b>T9.-</b> Calculus and horizontal reinforced concrete structural elements according to Código Estructural: beams and prestressed one-way slabs (unidirectional frameworks).	2	6
	Master class	<b>T10.-</b> Instantaneous and delayed deflection in building. ELS.	2	
12	Exercises	<b>T10.-</b> Instantaneous and delayed deflection in building. ELS.	4	6
13	Master class	<b>T11.-</b> Surface-foundation. Centered and eccentric footing. Centering beams.	4	6

14	Exercises	<b>T11.-</b> Surface-foundation. Centered and eccentric footing. Centering beams.	2	6
	Master class	<b>T12.-</b> Containment elements. Actions, analysis, dimensioning and assembly of reinforced concrete walls and basement cantilever according CTE-DB-C and Código Estructural.	2	
15	Master class	<b>T12.-</b> Containment elements. Actions, analysis, dimensioning and assembly of reinforced concrete walls and basement cantilever according CTE-DB-C and Código Estructural.	2	6
	Exercises	<b>T12.-</b> Containment elements. Actions, analysis, dimensioning and assembly of reinforced concrete walls and basement cantilever according CTE-DB-C and Código Estructural.	2	

## Evaluation

Evaluation activities	%	Dates
PA 1. Evaluation 1	41	Week 9
PA 2. Evaluation 2	41	Weeks 16 and 17
Practice nº1	6	Along the course
Practice nº2	6	Along the course
Practice nº3	6	Along the course
Examination recovery	50	Week19

### Guidelines for the evaluation of the course.

- The course is overcome with final 5.

### Note exams:

- In weeks 9 and 16 / 17a evaluation tests programmed are realized (written examinations) PA1 and PA2. The test PA1 has a weight of 41% and the second test PA2 has a weight of 41% of the final mark the subject.
- The evaluations do not eliminate material covered.
- Following the guidelines of the Framework Academic Degrees of EPS in the 19th week can be recovered subject. The recovery will be through a written exam on the whole subject. The maximum score is 5. This evaluation recovery, notes practices are not taken into account.

### Note exercises:

- Practices Nº1, Nº2 and Nº3 will be done in groups of two people.They have a weight of 18% of the final mark.
- The practices can not be recovered.

- The realization of all the practices by the student is mandatory. The student must solve practices delivered in paper format. Failure of a practice or the delivery out of time, involved note 0 in the practice concerned.

## Bibliography

### Theoretical foundations:

- Garcia Meseguer, A; Moran Cabre, F; Arroyo, JC; Jiménez Montoya. Esencial. Hormigón Armado. 16ª edición. Cinter. Divulgación técnica. Madrid 2018.
- Garcia Meseguer, A; Moran Cabre, F; Arroyo, JC; Jiménez Montoya. Hormigón Armado. 15ª edición. Gustavo Gili. Barcelona 2010.
- Rodriguez Val, J; Estructuras de la edificación. Hormigón Estructural. Editorial Club Universitario. Alicante 2010.
- Garcia Meseguer, A; Hormigón Armado. 3 vols. Uned. Madrid 2001.

### Codes and instructions:

- CTE. Ministerio de Fomento. 2006.
- Instrucción de Hormigón Estructural EHE08. Ministerio de Fomento. 2008.

### Exercises solved:

- Agullo, L; Aguado, A; Mari, A; Martinez F; Cobo, D; Hormigón armado y pretensado. Ejercicios. Edicions UPC. Politex 75. 1999.
- Bonet Senach, J.L; Castro Bugallo, M<sup>a</sup>C; Fernández Prada, M.A; Martí Vargas, J.R; Miguel Sosa, P; Navarro Gregori, J; Pallares Rubio, L; Cálculo de secciones y elementos estructurales de hormigón. 2 vols. Editorial Universitat Politècnica de València. 2011.
- Martinez Sierra, E; Liébana Carrasco, O; Martin Escudero, A; Cálculo y dimensionado de elementos de hormigón: Aplicación de EHE08. CEU Ediciones. Madrid 2010.

### Control and execution of work:

- Montero Fernández, E; Puesta en obra del hormigón. Consejo General de Arquitectura Técnica de España. 2006.
- Medina Sánchez, E; Construcción de estructuras de hormigón armado en edificación. Bellisco. Madrid. 2009.