BASIC DETAILS:

Subject:	ESTRUCTURAS II		
Id.:	30201		
Programme:	GRADUADO EN ARQUITECTURA. PLAN 2009 (BOE 21/03/2015)		
Module:	TECNICO		
Subject type:	OBLIGATORIA		
Year:	2	**Teaching period:**	Segundo Cuatrimestre
Credits:	3	**Total hours:**	75
Classroom activities:	28	**Individual study:**	47
Main teaching language:	Inglés	**Secondary teaching language:**	Castellano
Lecturer:		**Email:**	

PRESENTATION:

In the course "Estructuras I" presented the bases of structural mechanics knowledge, with spetial enphasis in the material resistance science.

This course, "Estructuras II", is presented as a continuation of the structural mechanics knowledge, focusing on the structural analysis science.

Structural analysis is the determination of the effects of loads on physical structures and their components. Structures subject to this type of analysis include all that must withstand loads, such as buildings, bridges, vehicles, furniture ans soil strata. Structural analysis employs the fields of applied mechanics, materials science and applied mathematics to compute a structure's deformations, internal forces, stresses, support reactiosn and stability. The results of the analysis are used to verify a structure's fitness for use, often precluding physical tests. Structural analysis is thus a key part of the engineering design of structures.

Thus, throughout the course there will be taught concepts as:

- Determinate and indeterminate structures

- Different analysis methods (Numerical, deformations, matrix)

- Structural analysis software

The subject therefore constitutes a continuation of the process initiated with the subject of Structures I to provide the student with the knowledge and skills necessary in fundamental aspects of the mechanics of solids and the elastic, plastic and resistant behavior of the elements of a structure. Thematic knowledge of the Theory of Elasticity and Strength of Materials is therefore included in it. For the student's knowledge of the computer tools of this subject, the management of a computer program will be explained that will allow him to verify the efforts obtained manually in the practical exercises developed, and interpret the results obtained in the mechanical calculation.

PROFESSIONAL COMPETENCES ACQUIRED IN THE SUBJECT:

General programme competences	G02	Ability to resolve problems and make decisions throughout their lifetime and choose professional and educational pathways independently.
	G03	Ability for autonomous learning and self-criticism.
	G04	Ability to transfer the knowledge acquired in practical work and skills to the field of work.
	G06	Demonstrate critical and analytical ability to conventional approaches of the discipline.
	G07	Demonstrate capacity for innovation, creativity and initiative.
Specific programme competences	E03	Knowledge applied to: Numeracy, analytical and differential geometry and algebraic methods.
	E04	Ability to conceive, calculate, design, integrate into buildings and urban units and execute: Building structures (T); Interior division systems, carpentry, stairways and other finished work (T); Locking systems, roof and other structural work (T); Foundation Solutions (T); Supply facilities, water treatment and disposal, heating and air conditioning (T).
Regulated profession	P06	Ability to understand the architectural profession and its role in society, in particular by developing projects that take social factors into account.

competences	P08	Understand the problems of the structural design, construction and engineering associated with building projects.
	P09	Adequate knowledge of physical problems and the different technologies and of the function of buildings so as to provide them with internal conditions of comfort and protection against the climate conditions.
	P10	Design capacity to meet the requirements of building users within the limits imposed by budget factors and building regulations.
Learning outcomes	R01	Understand and know how to apply the principles that define the energy functional conception of architectural structures.
	R02	Resolve structural problems in statically indeterminate models.
	R03	Understand and properly use the fundamental principles of balance against axial compression stresses generated by buckling.
	R04	Use, design and calculate lattice planes of articulated knots systems.
	R05	Use, design and calculate rigid knot structural systems.
	R06	Use fluidly in matrix method used for calculating bars.

PRE-REQUISITES:

Students must have a university-level of knowledge of physics and mathematics, taught in the previous courses, to be able to address and understand the concepts related to this course with guarantees. It is also needed a certain willingness to work in a guided but autonomous way the aspects of such knowledge that require a complementary review work.

CLARIFICATION NOTE: Students who are studying both first and second year courses that are taught within the same time period, are required to attend the new enrollment course while taking responsibility for keeping up to date the tasks planned for the older subject.

SUBJECT PROGRAMME:

Observations:

The course is divided in three main learning units:

- Structural safety. Students will learn about the regulations and criteria structures must follow to be correctly built. At the end of this unit there will be a written test (20%).

- Structural analysis. Main unit of the course. Students will learn about different ways to analyse a structure. The content of this unit will be examined in the final test (50%).

- Structural analysis software. With the structural safety and the numerical structural analysis concepts students will learn to use an analysis software to analyse structures. At the end of this unit, students must present the calculation of a simple house structure to prove they have understand the method (15%).

There will also be a special activity, developed in groups together with "Estructuras IV" students, where structural research skills will be tested (15%).

Subject contents:

1 - STRUCTURAL SAFETY
1.1 - Actions following CTE-DB-SE-A
1.2 - Limit states method
1.3 - Actions combination
2 - STRUCTURAL ANALYSIS BASES
2.1 - Continuous beams
2.2 - Equilibrium and compatibility
2.3 - Linearity and principle of superposition
3 - HYPERSTATIC STRUCTURES
3.1 - Statically indeterminate structures
3.2 - Degree of hyperstaticity

3.3 - Analysis methods
4 - DIFFERENTIAL EQUATION OF A DEFLECTED BEAM
4.1 - Conjugate beam theorem
4.2 - Navier law
4.3 - Mohr theorem
4.4 - Elastic equations
5 - WORK AND ENERGY
5.1 - Virtuales work
5.2 - Castigliano theorem
6 - COMPATIBILITY METHOD
6.1 - Imposed movements and deformations
6.2 - Continuous beams
6.2.1 - Three moments equation
6.2.2 - Imposed deformation
7 - EQUILIBRIUM METHOD
7.1 - Continuous beams
7.2 - Frames
8 - RIGIDITY METHOD
8.1 - Basic rigidity matrix
8.2 - Movements, efforts and reactions calculation
9 - STRUCTURAL SOFTWARE
9.1 - Introduction to CYPECAD
9.2 - Program interface
9.3 - Obtaining results, plans and reports

Subject planning could be modified due unforeseen circumstances (group performance, availability of resources, changes to academic calendar etc.) and should not, therefore, be considered to be definitive.

TEACHING AND LEARNING METHODOLOGIES AND ACTIVITIES:

Teaching and learning methodologies and activities applied:

Se aplicarán diferentes metodologías en función del tipo de actividad docente orientándose generalmente a la resolución de ejercicios prácticos y a la comprensión de conceptos teóricos. Se utilizarán diferentes medios para valorar la participación en las clases y el aprovechamiento de las mismas: supervisión de la realización de ejercicios, recogida de respuestas escritas, respuestas orales a cuestiones planteadas, etc.

-Clases presenciales teóricas: Clase magistral de transmisión de contenidos a través de la exposición oral con el apoyo de las TIC (utilización de pizarra, ordenador, proyector) resolviendo las dudas que surjan durante la sesión.

-Clases presenciales prácticas: El profesor guiará a los alumnos, agrupados convenientemente, en la resolución de las prácticas planteadas cada semana, resolviendo las dudas que surjan durante la sesión.

-Resolución colectiva de los trabajos prácticos planteados: El profesor detallará el proceso de resolución subrayando los puntos más importantes y aquellos en los que aprecie mas dificultades en los alumnos.

-Sesiones de tutoría: Durante estas sesiones, el estudiante podrá plantear al profesor, tanto de forma presencial, como a través de la plataforma virtual, todas aquellas dudas que no hayan podido ser solucionadas durante las clases presenciales.

-Trabajo personal: El alumno utilizará diferentes fuentes de información (apuntes, libros de referencia...), orientándose especialmente a la comprensión y repaso de los conceptos teóricos y a la resolución de problemas.

-Realización de pruebas escritas: Con ellas el profesor verificará la adquisición de los objetivos de aprendizaje del módulo, así como la adecuada progresividad en su asimilación.

Los estudiantes deben asistir a las actividades presenciales y tomar las orientaciones que se deriven de las clases magistrales, preparar las actividades prácticas previas a la realización de las clases y estudiar continuamente para conseguir el cumplimiento de objetivos de aprendizaje. Éstos se evaluarán de forma continua y sistemática a lo largo del cuatrimestre. El estudiante es responsable de planificar adecuadamente su trabajo atendiendo a las indicaciones de la presente guía docente y a las oreintaciones que reciba del profesor; así como de esclarecer las dudas que surjan del estudio en cualquiera de sus formas. Se insiste además en la conveniencia de asistir a las actividades que organice la ETSA USJ para lograr una formación avanzada.

Student work load:

Teaching mode	Teaching methods	Estimated hours
Classroom activities	Master classes	10
	Other theory activities	4
	Practical exercises	4
	Practical work, exercises, problem-solving etc.	4
	Coursework presentations	2
	Laboratory practice	2
	Other practical activities	2
Individual study	Tutorials	2
	Individual study	20
	Individual coursework preparation	10
	Group cousework preparation	5
	Research work	5
	Recommended reading	2
	Other individual study activities	3
	Total hours:	75

ASSESSMENT SCHEME:

Calculation of final mark:

Written tests:	20	%
Individual coursework:	15	%
Group coursework:	15	%
Final exam:	50	%
TOTAL	100	%

*Las observaciones específicas sobre el sistema de evaluación serán comunicadas por escrito a los alumnos al inicio de la materia.

BIBLIOGRAPHY AND DOCUMENTATION:

Basic bibliography:

GERE, James M. Timoshenko: Resistencia de Materiales. Thomson, 2006.
BEER, Ferdinand P. Mecánica de Materiales. Mc. Graw-Hill, 2007.
CERVERA RUIZ, Miguel. BLANCO DÍAZ, Elena. Mecánica de estructuras, libro 2, Métodos de análisis. Edicions UPC, 2002.
GOBIERNO DE ESPAÑA. Código Técnico de la Edificación, 2006.

Recommended bibliography:

FERNÁNDEZ CASADO, Carlos. Cálculo de estructuras reticulares. DOSSAT S.A Madrid, 1958
ORTIZ BERROCAL, Luis. Elasticidad. MC GRAW HILL, 1998

NASH, William A. Teoría y Problemas de Resistencia de Materiales. Schaum, Mc. Graw-Hill, 1992
GORDON, John Edward. Estructuras o por qué las cosas no se caen. Calamar Ediciones, 2006.
NELSON, J. y MCCORMAC, J. Análisis de Estructuras - Métodos Clásico y Matricial. Editorial Alfaomega, 2006.

Recommended websites:

Estructurando	http://estructurando.net/
CTE-DB-SE	https://www.codigotecnico.org/index.php/menu-seguridad-estructural.html
Engineering mathematics	https://www.mathalino.com/
La web del ingeniero civil	https://civilgeeks.com/

* Guía Docente sujeta a modificaciones