Course guide
210121 - EST II - Structures II

Last modified: 16/02/2024

Unit in charge: Barcelona School of Architecture
Teaching unit: 753 - TA - Department of Architectural Technology.

Degree: DEGREE IN ARCHITECTURE STUDIES (Syllabus 2014). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish, English

LECTURER

Coordinating lecturer: LUCRECIA JANNETH CALDERÓN VALDIVIEZO

Others:

Primer quadrimestre:
FRANCESC XAVIER ALDABO FERNANDEZ - Grup: 1SMA, Grup: 1SM1, Grup: 1ST1
LUCRECIA JANNETH CALDERÓN VALDIVIEZO - Grup: 1SM1, Grup: 1ST1
FRANCISCO JAVIER TORRE-MARIN RODRÍGUEZ - Grup: 1SM1, Grup: 1ST1

Segon quadrimestre:
FRANCESC XAVIER ALDABO FERNANDEZ - Grup: 2SM2, Grup: 2ST2
LUCRECIA JANNETH CALDERÓN VALDIVIEZO - Grup: 2ST2
FRANCISCO JAVIER TORRE-MARIN RODRÍGUEZ - Grup: 2SM2
LAURA VALVERDE ARAGON - Grup: 2ST2

REQUIREMENTS

It is necessary to have a minimum grade of 4 in Structures I.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
ET13. Translation from Spanish slope
ET14. Translation from Spanish slope
ET2. Translation from Spanish slope
ET1. Translation from Spanish slope
ET3. Translation from Spanish slope
ET10. Translation from Spanish slope
ET6. Translation from Spanish slope
ET4. Translation from Spanish slope
ET7. Translation from Spanish slope
ET8. Translation from Spanish slope

Generical:
CG4. Translation from Spanish slope

Transversal:
CT2. Translation from Spanish slope
CT3. Translation from Spanish slope
CT4. Translation from Spanish slope
CT5. Translation from Spanish slope

Basic:
CB1. Translation from Spanish slope
CB2. Translation from Spanish slope
CB3. Translation from Spanish slope
CB4. Translation from Spanish slope
CB5. Translation from Spanish slope

TEACHING METHODOLOGY

Go to catalan or spanish version.

LEARNING OBJECTIVES OF THE SUBJECT

The course STRUCTURES II is the core course of the area of the theory of structures corresponding to the third year of the Degree in Architecture Studies (GArqETSAB).

The objective of this course is that the student understands and learns the basic general principles for the global design of medium-rise building structures, the suitability of the structural typology and the material, and that he can develop an integrated architectural and a structural design.

The course focuses on reinforced concrete moment-resisting frames and one-way and two-way slabs. It defines the suitability and the feasibility of each structural typology, as well as emphasizes the relationship between Architecture and Structural Design. As a result, the student may be able to do the preliminary design of the main members of the structure (columns, beams and slabs), and the determination, at a basic level, of their internal forces and reinforcement.
In addition, the course establishes the fundamental concepts that enable the students to deepen in more specific or complex studies through optional courses or official postgraduate programs that are taught from the department itself. The theoretical explanation is complemented by some practical exercises that are related to the design of building structures.

STUDY LOAD

Type	Hours	Percentage
Self study	84,0	56.00
Hours medium group	32,0	21.33
Hours large group	22,0	14.67
Guided activities	12,0	8.00

Total learning time: 150 h

CONTENTS

- Course outline

Description:
The course is developed around a common backbone, the project of reinforced concrete frame structures for residential or office buildings. The students will work in a specific building throughout the course, from the preliminary design to the analysis of the main members of the structure.

The course covers the following topics:

- Introduction to reinforced concrete structures
- General approach to the structural project
- Actions in buildings and basis of structural design
- Introduction to materials: concrete and steel
- Global analysis of structures: Calculation methods, concept of stiffness, determination of internal forces
- Preliminary design of structures. General criteria and methods for slab, beams and columns
- Use of the Wineva program to generate efforts
- Axial forces, general design principles
- Pure bending: longitudinal reinforcement of rectangular shaped beams
- One-way and two-way building slabs
- Tangential forces: Shear and punching
- Combined axial and bending: buckling and column reinforcement
- The importance of detailing in structures
- Other structural systems.

Full-or-part-time: 150h
Theory classes: 26h 20m
Laboratory classes: 39h 40m
Self study : 84h

GRADING SYSTEM

Continuous assessment
Continuous assessment will be based on two practical midterm exams that may also include some theoretical questions, either multiple-choice or short-answer type. These two written midterm exams will have a weight of 60% in the continuous assessment. The course also includes some assignments, which will be developed during class hours and will have a weight of 15%, and which in the end will form part of a work to be delivered that will include structural plans equivalent to 20 % in the continuous evaluation. A 5% is reserved in the continuous evaluation destined to the recovery of some of the practices.
To be eligible for MH Honors, students must obtain a continuous-assessment mark higher than 9.00 and must inform the course coordinator (within a period not exceeding one week from the publication of the continuous-assessment marks) to prepare a specific exam.

Final assessment
If the student does not pass the continuous assessment, a final global exam can be carried out, in the format established by the teaching staff. This comprehensive final examination will cover the material from the entire course.

Telematic continuous assessment
In online teaching situations, continuous assessment will be carried out synchronously and asynchronously, by the methods established by the University and the School, with a periodic record of academic activity by submitting assignments, forums, questionnaires or any other means provided by the Atenea platform, or the alternative tools provided to the teaching staff. In situations in which this telematic teaching takes place when faceâ□□toâ□□face teaching has already begun, or for nonâ□□academic reasons, any alterations to the weightings or regular teaching control systems will be communicated in detail to all students on the Atenea platform for every subject.

Final telematic assessment
If the continuous telematic assessment is not positive, a second assessment may be carried out consisting of a final overall test in telematic format to be established in accordance with the criteria of the lecturers in charge and the ICT resources and tools provided by the University or the School. The measures for adapting to distance teaching will be implemented in accordance with ICT security and personal data protection criteria to ensure compliance as regards Personal Data Protection legislation (RGPD and LOPDGDD).

BIBLIOGRAPHY

Basic:
- Arroyo Portero, Juan Carlos; Jiménez Montoya, P; Morán Cabré, Francisco;. Hormigón armado [on line]. 16ª edición, revisada, reducida y complementada. [Madrid]: Cinter Divulgación Técnica, 2018 [Consultation: 16/09/2020]. Available on: http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=9288. ISBN 9788493930578.
- Calavera Ruiz, José. Cálculo, construcción, patología y rehabilitación de forjados de edificación : unidireccionales y sin vigas-hormigón metálicos y mixtos. 5ª ed. Madrid: Instituto Técnico de Materiales y Construcciones (INTEMAC), DL 2002. ISBN 8488764149.
- Torroja, Eduardo. Razón y ser de los tipos estructurales. 3ª ed. rev. Madrid: Consejo Superior de Investigaciones Científicas. Instituto de Ciencias de la Construcción 'Eduardo Torroja', 2007. ISBN 9788400086121.
- Timoshenko, Stephen; Woinowsky-Krieger, S.. Teoría de placas y láminas. Bilbao: Urmo, 1975.
- Calavera Ruiz, José; García Dutari, Luis. Cálculo de flechas en estructuras de hormigon armado : forjados, losas, vigas de canto, vigas planas. Madrid: INTEMAC, 1992. ISBN 8487892086.
- Buxadé, Carles; Margarit, Joan. Disseny i càlcul de seccions de formigó armat i sostres sense bigues [on line]. Barcelona: ETSAB, 1982 [Consultation: 08/05/2020]. Available on: http://hdl.handle.net/2117/90677.
- Calavera, José. Proyecto y cálculo de estructuras de hormigón: en masa, armado, pretensado. Madrid: Instituto Técnico de Materiales y Construcciones, 1999. ISBN 84-88764-05-7.
- Gómez, Pepa; Gómez, Josep Vicent. Estructures de formigó armat: predimensionament i càlcul de seccions [on line]. Barcelona: Edicions UPC, 2002 [Consultation: 08/05/2020]. Available on: http://hdl.handle.net/2099.3/36800. ISBN 84-8301-586-2.
- Jiménez, Pedro et al.. Hormigón armado. 15ª ed. Barcelona: Gustavo Gili, 2009. ISBN 9788425223075.
- Mañà, Fructuós. El gros de l'obra: uns apunts de construcció [on line]. Barcelona: Edicions UPC, 2000 [Consultation: 06/05/2015]. Available on: http://hdl.handle.net/2099.3/36296. ISBN 84-8301-370-3.
- Moya i Ferrer, Lluís. Análisis matricial de estructuras de barras [on line]. Barcelona: Edicions UPC, 1995 [Consultation: 16/09/2020]. Available on: http://hdl.handle.net/2099.3/36289. ISBN 8489636419.
- Ching, Frank; Zuberbuhler, Douglas; Onouye, Barry. Manual de estructuras ilustrado. Segunda edición ampliada. Barcelona: Editorial Gustavo Gili, 2020. ISBN 9788425232725.
- Allen, Edward; Zalewski, Waclaw. Form and forces : designing efficient, expressive structures [on line]. Hoboken, N.J.: John Wiley & Sons, cop. 2010 [Consultation: 15/06/2023]. Available on: https://discovery.upc.edu/permalink/34CSUC_UPC/19srfpi/cdi_proquest_miscellaneous_200114438. ISBN 9780470174654.

Complementary:
- Asociación Nacional de Fabricantes con Sello CIETAN. Recomendaciones para la ejecución de forjados unidireccionales. [Madrid]: L'associació, 1991. ISBN 8460410935.
- Delibes, Adolfo. Tecnología y propiedades mecánicas del hormigón. 2ª ed. Madrid: INTEMAC, 1993. ISBN 84-88764-01-4.
- Argüelles, Ramón. Cálculo de estructuras. Madrid: Escuela Técnica Superior de Ingenieros de Montes, 1981-1986. ISBN 84-600-2410-5.
- Buxadé, Carles; Margarit, Joan. Cálculo de estructuras con pórticos y pantallas [on line]. Barcelona: Blume, 1977 [Consultation: 14/10/2022]. Available on: https://discovery.upc.edu/permalink/34CSUC_UPC/rdgucl/alma991000469389706711.
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- Calavera Ruiz, José. Cálculo de estructuras de cimentación. 4 ed. Madrid: INTEMAC, 2000. ISBN 84-88764-09-X.
- Calavera, José. Muros de contención y muros de sótano. 3ª ed. Madrid: Instituto Técnico de Materiales y Construcciones, 2001. ISBN 84-88764-10-3.

RESOURCES

Other resources:
Notes of the course will be available in Atenea.

The teaching material corresponding to the following week will be published in advance, so that the student can prepare the classes.

The following material will be also published in Atenea:
- The reference standards (the Spanish Structural Code and the Eurocodes)
- Worked exercises from previous courses

The materials and documents of the subject may be written indistinctly in any languages of instruction.