Approval date: 17/06/2024

COURSE GUIDE

Construction 1: Load-Bearing Structures (Steel, Wood, Brick) (2091127)

Grado (Bachelor's Degree)	Grado en Estudios de Arquitectura	Branch	Technology, Engineering and Architecture
Module	Sistemas Constructivos en Arquitectura	Subject	Construcción

Year of study	2º	Semester	2º	ECTS Credits	6	Course type	Compulsory course

PREREQUISITES AND RECOMMENDATIONS

- Have completed the subjects of Basis to Construction, Building Materials and Physical Basis applied to Structures
- Have sufficient knowledge of graphic expression and drawing techniques. Reading and interpretation of architectural plans

BRIEF DESCRIPTION OF COURSE CONTENT (According to the programme's verification report)

- Structural constructive systems: Steel structure construction. Wood structure construction. Brickwork structure construction
- Materiality, technique and architecture
- Technology of the structural constructive systems for the architectural project
- Pre-sizing. Building execution. Monitoring and control. Design and execution of the structural constructive systems in architecture: Design, typologies, analysis, regulations, execution and quality control

SKILLS

GENERAL SKILLS

- CG01 - Capacidad de análisis y síntesis
- CG02 - Capacidad de organización y planificación
- CG03 - Comunicación oral y escrita en la lengua nativa
- CG04 - Conocimiento de una lengua extranjera
- CG06 - Capacidad de gestión de la información
- CG07 - Resolución de problemas
- CG08 - Toma de decisiones

- CG10 - Trabajo en un equipo de carácter interdisciplinar
- CG16 - Aprendizaje autónomo
- CG18 - Creatividad
- CG22 - Motivación por la calidad
- CG23 - Sensibilidad hacia temas medioambientales
- CG24 - Trabajo en colaboración con responsabilidades compartidas
- CG25 - Habilidad gráfica general
- CG27 - Visión espacial

SUBJECT-SPECIFIC SKILLS

- CE04 - Aptitud para concebir, calcular, diseñar, integrar en edificios y conjuntos urbanos y ejecutar: a) Estructuras de edificación; b)Sistemas de división interior, carpintería, escaleras y demás obra acabada; c) Sistemas de cerramiento, cubierta y demás obra gruesa; d) Soluciones de cimentación; e) Instalaciones de suministro, tratamiento y evacuación de aguas, de calefacción y de climatización.
- CE05 - Aptitud para: a) Aplicar las normas técnicas y constructivas; b) Conservar las estructuras de edificación, la cimentación y obra civil; c) Conservar la obra acabada; d) Valorar las obras.
- CE06 - Capacidad para: a) Conservar la obra gruesa; b) Proyectar instalaciones edificatorias y urbanas de transformación y suministro eléctricos, de comunicación audiovisual, de acondicionamiento acústico y de iluminación artificial; c) Conservar instalaciones.
- CE07 - Conocimiento adecuado de: a) La mecánica de sólidos, de medios continuos y del suelo, así como de las cualidades plásticas, elásticas y de resistencia de los materiales de obra pesada; b) Los sistemas constructivos convencionales y su patología; c) Las características físicas y químicas, los procedimientos de producción, la patología y el uso de los materiales de construcción; d) Los sistemas constructivos industrializados.
- CE32 - Aptitud para la concepción, la práctica y desarrollo de: a) Proyectos básicos de ejecución; b) Proyectos urbanos; c) Dirección de obras.
- CE33 - Aptitud para concebir, calcular, diseñar, integrar en edificios y conjuntos urbanos y ejecutar: a) Sistemas de división interior, carpintería, escaleras y demás obra acabada; b) Sistemas de cerramiento, cubierta y demás obra gruesa.
- CE34 - Aptitud para: a) Intervenir en y conservar, restaurar y rehabilitar el patrimonio construido; b) Suprimir barreras arquitectónicas; c) Aplicar las normas técnicas y constructivas; d) Conservar la obra acabada; e) Valorar las obras.
- CE35 - Capacidad para: a) Conservar la obra gruesa; b) Realizar proyectos de seguridad, evacuación y protección en inmuebles; c) Redactar proyectos de obra civil.
- CE36 - Conocimiento adecuado de: a) Los sistemas constructivos convencionales y su patología; b) Las características físicas y químicas, los procedimientos de producción, la patología y el uso de los materiales de construcción; c) Los sistemas constructivos industrializados; d) Las técnicas de modificación del terreno; e) La ecología, la sostenibilidad y los principios de conservación de recursos energéticos y medioambientales; f) Las tradiciones arquitectónicas, urbanísticas y paisajísticas de la cultura occidental, así como de sus fundamentos técnicos, climáticos, económicos, sociales e ideológicos; g) La relación entre los patrones culturales y las responsabilidades sociales del arquitecto.

LEARNING OUTCOMES

The fundamental thing in this subject is to create in the student an open and scientific spirit that enables him to assume the continuous changes that occur both in society and in the office of

Architect, to know them, to assimilate them and even to star in them.
In this subject the construction of building structures is addressed, essentially, this implies two fundamental aspects that must be covered by the teaching. The student must know technologies and systems to undertake without reservation the processes of the architectural project and its material execution, (as regards the structure especially), with the implications that this implies; it must therefore be generated:

- Ability to generate building structures as a basic part of the architectural project that meet aesthetic requirements and techniques.
- Knowledge of research methods and preparation of the construction project.
- Knowledge of the problems of structural design, its construction linked to building projects.
- Adequate knowledge of the regulations and procedures for translating building projects.

PLANNED LEARNING ACTIVITIES

THEORY SYLLABUS

Block I. Introduction to building structures

- Lesson 1
  - The supporting structure in building, concept and typologies.
  - Regulations: CTE and complementary regulations. Building actions
  - Mechanical behavior of the structure. Structural elements, usual forms of work. Limits states, working stresses. Materials in the design and construction of structures.
  - The soil to support the building; the geotechnical report.
  - Foundation, concept and classification of foundations. Surface foundations, pre-dimensioning.

Block II. Brickwork

- Lesson 2. Introduction.
  - Concept and types of brickwork. Regulations.
  - Manufacture of natural elements.
    - Wall, masonry, ashlar. Construction arrangements.
- Lesson 3. Brickworks
  - Brick walls
    - Classification of brickwalls, nomenclature. Materials and binders. Resistant capacity; yarns, joints, keys. Rigging and brickwork meetings. Laws of work. Load walls. Gaps. Arches and vaults: Construction provisions. Execution of brickworks.
- Lesson 4
  - Blockworks.
    - Elements of the walls. Construction arrangements. Execution of the blockworks
  - Armed blockworks
    - Armed factories; concept and function. Usual applications and construction arrangements. Execution of armed factories.
  - Control and maintenance of factories.

Block III. Steel structure

- Lesson 5. Introduction to steel structures.
  - General. Steel properties. Frameworks structures and triangulated structures; organization.
  - The material: Types of profiles, characteristics, qualities and frequent uses. Commercial forms. Working method, permissible stresses. Connections.

- Lesson 6. Metal networks.
  - Supports, mechanical function. Foundation starts. Types of supports. Knots. Section changes. Singular arrangements.
  - Beams, mechanical function. Types of beams. Stiffeners, posters and flights. Beams of variable section.
- Lesson 7. Forgings
  - Organization of the forging, constituent elements and mechanical function. Metal beam forgings. Collaborating sheet forgings. Mixed forgings. Supports on factories and massifs. Stairs.
- Lesson 8. Triangulated structures.
  - Lightened soul beams. Lattice beams. Knots and supports.
  - Trusses. Types and constructive organization, solutions for decks with different skirts.
  - Solutions and examples for diaphanous plants and large lights.
  - Spatial structures . Concept, types and uses. Constructive solutions and examples.
- Lesson 9. Control and maintenance
  - Control and maintenance of the metal structure. Protection against moisture. Fire protection.

Block IV. Wood

- Lesson 10. Introduction to wood construction
  - Wood as a construction material. Forest species. Obtaining the material and transformations.
- Lesson 11
  - Material, characteristics, internal structure and mechanical behaviour. Properties, defects and classifications.
  - Carpentry. Joints between parts, traditional joints, connectors and metal elements, adhesives. Wood derivatives; boards, types, commercial forms and frequent uses.
- Lesson 12
  - Wood degradation. Behavior against moisture and fire. Environmental aggressions and xylophagous agents. Protective treatments. Regulation and testing.
- Lesson 13. Constructive systems
  - Traditional systems. Foundations. Right feet. Forged. Roofs. Half-timbered solutions. Mixed solutions with factory works.
- Lesson 14
  - Non-traditional systems. Prefabricated solutions. Installation insertion. Manufacture, commissioning and control.
- Lesson 15. Laminated wood
  - Laminated wood. Concept and manufacture. Laminated wood structures, characteristics, dimensions, uses. Behavior before fire. Protective treatments

PRACTICAL SYLLABUS

- A practical exercise on brick works.
  - Exercise of an individual character.
- Realization of two practical exercises on steel construction, construction of structures, its design and dimensioning, its commissioning. The first on a building with a half-timbered structure, the second on a building that requires covering systems to house diaphanous spaces inside.
  - The exercises will be conducted with students organized in working groups.
- A practical exercise on simple wood construction.
  - The exercise will be carried out with students organized in working groups.

- Monographs of free choice; exercises accepted by the teacher on proposals of the students, to develop concrete aspects of the agenda. These exercises will be voluntary and will be carried out individually. The implementation of exercises of this type on topics in Blocks I, II and IV shall replace the practical exercises in paragraphs 1 and 3 above.

RECOMMENDED READING

ESSENTIAL READING

What is selected (a sufficient summary) has different origins: it comes, in some cases from books of general type, and in others, it is specific to specific themes on construction or construction of structures particularly and, manuals and other technical or scientific publications. Norms issued by qualified bodies (Professional Institutes and Colleges) or provisions of the State Administration are collected.
This bibliographical list is organized according to the sequence of the subject's program in:

- Basic or fundamental, bibliography recommended for the whole subject, especially for Block I of the agenda, and in general for the study of Construction.
- Additional or complementary, more specific bibliography in relation to the contents of the remaining blocks of the agenda.

Fundamental or basic bibliography:

- Ley 38/1999 sobre Ordenación de la Edificación.
- CTE, Código técnico de la edificación Real decreto 314/2006, texto refundido R/D 1371/2007 de 19 de octubre. Corrección de errores BOE de 25/1/y texto refundido de 30/1/2.008. Orden 984/2009, de 15 de abril, modifica determinados documentos básicos del Código Técnico.
- CTE DB SE-C Seguridad estructural: Cimientos
- CTE DB SE-AE Acciones de la Edificación
- Código Estructural /Real Decreto 470/2021 de 29 de junio /Ministerio de la Presidencia, Relaciones con las Cortes y Memoria.
- EHE-08 Instrucción de Hormigón Estructural: / Real Decreto 1247/2008 de 18 de julio. / Ministerio de Fomento (derogada)
- NCSE-02 Norma de construcción sismorresistente. Parte general y de edificación / Real Decreto 997/2002 de 27 de septiembre.7Ministerio de Fomento
- NORMAS TECNOLOGICAS DE LA EDIFICACION / Decreto 3.561/1.972 de 23/12 B.O.E. de 15/enero/1.973 / Ministerio de la Vivienda
- NTE – Acondicionamiento del terreno / NTE- Cimentaciones / NTE- Estructuras
- LA CONSTRUCCION DE LA ARQUITECTURA / Ignacio Paricio Ansuategui / Instituto Tecnológico de la Construcción de Cataluña
- MANUAL DE LA EDIFICACION. / Antonio García Valcárcel y otros. / EUNSA
- RAZON Y SER DE LOS TIPOS ESTRUCTURALES / Eduardo Torroja. / Consejo Superior de Investigaciones Científicas
- THE ESTRUCTURES OF EDUARDO TORROJA / Mario Salvadori. / Ministerio de Fomento CEDEX-CEHOPU
- SISTEMAS ESTRUCTURALES / Eino Ángel / Gustavo Gili
- BANCO DE DETALLES ARQUITECTONICOS / Francisco Alcalde Pecero / Marsay ediciones. Sevilla
- MUROS DE CONTENCION Y MUROS DE SOTANO / José Calavera Ruiz / INTEMAC
- CIMIENTOS Zapatas(I) / José Luis de Miguel Rodríguez / Cuadernos del Instituto Juan de Herrera
- PROYECTO Y CALCULO DE ESTRUCTURAS DE HORMIGON / José Calavera Ruiz / INTEMAC

COMPLEMENTARY READING

- Block II
  - CTE DB SE-F Seguridad Estructural. FABRICAS.
  - EUROCODIGO 6: Proyecto de Estructuras de Fábrica FÁBRICA / AENOR
  - EL LADRILLO Y SUS FABRICAS / Fernando Cassinello Pérez / Manuales y Normas INSTITUTO EDUARDO TORROJA
  - BOVEDAS Y CUPULAS DE LADRILLO / Fernando Cassinello Pérez / Manuales y Normas INTITUTO EDUARDO TORROJA
  - OBRAS DE FÁBRICA. P.i.e.t. 70 / Prescripciones del Instituto Eduardo Torroja
  - LA OBRA DE FABRICA DE LADRILLO / S. Smith / Editorial Blume
  - EL MURO DE LADRILLO J.M. Adell Argiles y otros / HISPALIT
  - CONTROL DE OBRAS DE FABRICA / Javier Lahuerta Vargas y otros / Publicaciones del C.O.A.M.
  - RL-88: Pliego General de Condición para la Recepción de Ladrillos Cerámicos en obras de construcción. / Ministerio de Fomento
  - RB-90: Pliego de Prescripciones Técnicas Generales para la Recepción de Bloques de Hormigón en obras de Construcción. / Ministerio de Fomento.
- Block III
  - CÓDIGO ESTRUCTURAL. PARTE ESTRUCTURAS DE ACERO Y MIXTAS. REAL DECRETO 470/2021 DE 29 DE JUNIO
  - CTE DBE-A Seguridad Estructural. ACERO
  - NTE-EA Estructuras de acero
  - ATLAS DE LA CONSTRUCCION METALICA / Hart-Henn-Sontag / Gustavo Gili.
  - CONSTRUIR EN ACERO / Ramón Araujo, Enrique Seco / Publicaciones de ENSIDESA
  - LA ESTRUCTURA METALICA HOY / Ramón Arguelles Álvarez / L.T. Bellisco
  - CURSO DE ESTRUCTURAS METALICAS / Luis Felipe Rodríguez Martin / Publicaciones del COAM
  - CURSO DE CONTROL DE CALIDAD DE ESTRUCTURAS METALICAS / Rafael Heredia Scasso / Publicación es del COAM
  - CALCULO, CONSTRUCCION Y PATOLOGIA DE LOS FORJADOS DE EDIFICACION / José Calavera Ruiz / INTEMAC
  - CONSTRUCCION CON PERFILES TUBULARES- Guías de diseño, siete volúmenes/ Varios autores / Instituto para la Construcción Tubular
  - LAS ESTRUCRURAS TUBULARES EN LA ARQUITECTURA / Mick Eekhout / Instituto para la Construcción Tubular
  - ESTRUCTURAS ESPACIALES DE ACERO / Makowski / Gustavo Gili
  - FORJADOS COMPUESTOS DE CHAPA NERVADA Y HORMIGON, VENTAJAS E INCONVENIENTES / J. Jordan de Uries / Cuadernos de INTEMAC
- Block IV
  - CTE DB SE-M Seguridad Estructural MADERA
  - EUROCODIGO 5 / Proyecto de Estructuras de Madera / AENOR
  - CARPINTERIA / Fernando Cassinello Pérez / Ed. Rueda
  - DISEÑO DE ESTRUCTURAS EN MADERA. / Miguel Ángel Rodríguez Nevado, María del Mar Sánchez Marcos / AITIM (Asociación de Investigación Técnica de las Industrias de la Madera y Corcho)
  - ESTRUCTURAS DE MADERA, CALCULO Y DISEÑO / Ramón Arguelles Álvarez , Francisco Arriaga Martitegui, Juan José Martínez Calleja / AITIM
  - GUIA DE LA MADERA / Francisco Arriaga Martitegui y otros / AITIM
  - ESPECIES DE MADERA / Antonio Guindeo Casares y otros / AITIM
  - TECNOLOGIA DE LA MADERA / Santiago Vignote Peña, Francisco Javier Jiménez Peris / Ministerio de Agricultura Pesca y Alimentación, Secretaria General Técnica, servicio de Publicaciones

- ARQUITECTURA NORDICA EN MADERA / Yiva Lipkin / Nordic Timber Council AB (Consejo Nórdico de la Madera)
- MADERA LAMINADA ENCOLADA ESTRUCTURAL (MLE) Resistencia al fuego y características mecánicas / Francisco Javier Jiménez Peris, Isabel Cuevas Espinosa, Enrique Morales Méndez / Junta de Andalucía, Consejería de Medio Ambiente.

RECOMMENDED LEARNING RESOURCES/TOOLS

The information available today in the computer networks is wide and changing, some of the portals and pages that can be consulted are indicated as a starting point only. It will be during the development of each topic where specific links will be exposed that may be interesting for the expansion of information or for a better understanding of the subject by students.

- Eduardo Torroja Institute
- Institute of Construction Technology of Catalonia
- Documents, legislation, publications, Software, etc.

TEACHING METHODS

- MD01 - Lección magistral/expositiva
- MD03 - Resolución de problemas y estudio de casos prácticos
- MD07 - Seminarios
- MD08 - Ejercicios de simulación
- MD09 - Análisis de fuentes y documentos
- MD10 - Realización de trabajos en grupo

ASSESSMENT METHODS (Instruments, criteria and percentages)

ORDINARY EXAMINATION DIET

Instruments of continuous evaluation.

- Written tests: short answer, objective, cases or assumptions, problem solving.
- Oral tests: exhibition of works (individual or in groups), interviews.
- Extensive graphical tests with descriptive, analytical and/or projectual answers.
- Works, reports, studies, memories, etc.

Evaluation criteria.

- Verification of the mastery of content, theoretical and practical, and critical elaboration thereof.
- Assessment of the work done, individually or in a team, according to the presentation, writing and clarity of ideas, graphics, structure and scientific level, creativity, justification and richness of the work done.
- Degree of involvement and attitude of students expressed in their participation in exhibitions and debates, as well as in the preparation of individual or team work.
- Attendance at theoretical and practical classes, seminars, conferences, tutorials.

Criteria for continuous assessment.

- 60% Individual Tests and/or Ordinary Final Examination.
- 35% Controls, Practices and Tests performed on equipment.
- 5% Attendance and participation.

To qualify for the ordinary final test it is necessary to reach 80% of effective assists, and to pass the subject obtain a final score equal to or greater than 5, provided that both the final test and the average of the other controls and practices achieve a minimum rating of 3,0 out of 10.

EXTRAORDINARY EXAMINATION DIET

Tool: Use of computer in classroom or videoconference

- Description: Individual knowledge check through face-to-face computer development tests in the classroom or online as appropriate, always using the Prado platform (avoiding the use of paper).
- Evaluation criteria: Acquisition of competences in the theoretical taught subject - practical according to the provisions of the Teaching Guide of the subject (individual tests).
- Percentage of final qualification: individual knowledge: 100%

SINGLE FINAL ASSESSMENT (evaluación única final)

Tool: Use of computer in classroom or videoconference

- Description: Individual knowledge check through online development tests
- Evaluation criteria: Acquisition of competences in the theoretical taught subject - practical according to the provisions of the Teaching Guide of the subject (individual tests).
- Percentage of final qualification: individual knowledge: 100%

ADDITIONAL INFORMATION

The teaching organization of each group and in each academic year, will modify, if necessary, previously justifying the present guide of the subject of Construction 1
Información de interés para estudiantado con discapacidad y/o Necesidades Específicas de Apoyo Educativo (NEAE): Gestión de servicios y apoyos (https://ve.ugr.es/servicios/atencion-social/estudiantes-con-discapacidad).