

Course guide

310403 - 310403 - Building Structures

Last modified: 15/02/2024

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

Degree: MASTER'S DEGREE IN ADVANCED BUILDING CONSTRUCTION (Syllabus 2014). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 5.0 **Languages:** Spanish

LECTURER

Coordinating lecturer:

Pujadas Álvarez, Pablo

Others:

PRIOR SKILLS

This list includes the previous knowledge necessary to be able to take advantage of the master's subjects. The required level of mathematics corresponds approximately to the last pre-university courses.

Mathematics

- ☐§ Algebraic and transcendent operations. Algebraic, exponential, rational, potential, trigonometric, hyperbolic functions.
- ☐§ Matrices. Sum and product of matrices. Inverse of a matrix. Determinant. Singular matrices. Range of a matrix.
- ☐§ Systems of linear equations. Discussion and resolution.
- ☐§ Vectors in the plane and in space. Euclidean geometry. Scalar product, norm, orthogonality, angle between vectors. Equations of lines and planes. Parabolas, ellipses and hyperbolas.
- ☐§ Derivatives. Geometric interpretation. Chain rule.
- ☐§ Integration. Primitive functions. Barrow's rule. Area calculation.
- ☐§ Graphical representation of functions. Maxima, minima and inflection points. Asymptotes.
- ☐§ Statistics. Probability. Mean and median values. Standard deviation.

Mechanics

- ☐§ Equations of equilibrium in the plane and in space. Resulting force and resulting moment. Concentrated and distributed forces.
- ☐§ Center of gravity. Static moment. Moment of inertia. Principal directions of inertia. Radius of gyration.

Strength of materials

- ☐§ Isostatic and hyperstatic structures.
- ☐§ Obtaining reactions of isostatic structures.
- ☐§ Diagrams of axial forces, shear forces and bending moments.
- ☐§ Deformations. Deflection, rotation and curvature.
- ☐§ Sectional behavior. Axial force. Pure, simple and composed bending.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

6. Describe phenomenons of exchange of heat, thermic perception, quality of the interior air, ventilation, illumination conditions and propagation and control of noise.
7. Design climatization objects, lifts, security systems and surveillance, domotic installations and network of communication and information.

Generical:

8. Prepare to communicate with efficiency, orally but also in written.
11. Provide to the student the capacity to apply the knowledge acquired in the resolution of complex problems in any sector of the building construction.
12. Prepare the student in the using of tools that are common in the investigation activities, like the analysis and treatment of data, just like methodology and investigation techniques.

Transversal:

9. TEAMWORK. Being able to work as a team player, either as a member or as a leader. Contributing to projects pragmatically and responsibly, by reaching commitments in accordance to the resources that are available.
10. EFFECTIVE USE OF INFORMATION RESOURCES. Managing the acquisition, structure, analysis and display of information from the own field of specialization. Taking a critical stance with regard to the results obtained.

Basic:

2. Possess and understand knowledge which provide a basis or opportunity to be original in the development and/or application of ideas, usually in a context of research.
3. The students must be able to apply the acquired knowledges and their ability of resolution of problems in new or little known environments inside more wide environments (or multidisciplinary) related with their study field.
4. The students must be able to integrate knowledges and front to the complexity to formulate opinions from an information which, being incomplete or limited, includes reflections about the social and ethical responsibilities linked to the application of their knowledges and opinions.
5. The students must be able to communicate their conclusions and the knowledges and ultimate reasons which support to specialised and non-specialised audiences in a clear mode and without ambiguities.
1. The students must possess the learning abilities which allow them to continue studying in a way which should be to a large extent self-directed and autonomous.

TEACHING METHODOLOGY

Master class: Exposition of knowledges by the faculty.

Exposition participative class: Organised from the exposition of the faculty and the involvement of the students around questions or topics suggested by the faculty.

Tutorials and questions: Supervision of the student work.

Guidance of works and autonomous practices: resolution of exercises in class; exposition in class of an activity fulfilled in class individually or in small groups.

Evaluation tests: Fulfilment of written activities of evaluation, individually and presencially.

LEARNING OBJECTIVES OF THE SUBJECT

By the end of the course, the student should be able to:

- Understand the general features of seismic actions.
- Evaluate, in qualitative terms, the earthquake-resistant capability of a building.
- Design a building with simple characteristics located in a seismic zone.

STUDY LOAD

Type	Hours	Percentage
Guided activities	7,5	6.00
Hours large group	17,5	14.00
Hours small group	5,0	4.00
Self study	90,0	72.00
Hours medium group	5,0	4.00

Total learning time: 125 h

CONTENTS

C1 SEISMIC BEHAVIOUR OF STRUCTURES

Description:

Earthquakes. Seismicity. Effects of seismic actions on buildings. Conceptual earthquake resistant design. Seismic regulations (codes). Basic strategies of earthquake-resistant design. Concrete buildings. Steel buildings. Base (seismic) isolation.

Specific objectives:

To analyze and understand the behaviour of a building structure undergoing seismic effects.

Related activities:

A1 and A2

Full-or-part-time: 84h 30m

Theory classes: 26h

Practical classes: 10h

Self study : 48h 30m

GRADING SYSTEM

According to the Master's Study Plan, there will be a continuous evaluation and an extraordinary exam

Continuous evaluation. Two exercises: (1) Present examples of real buildings that have various earthquake resistance deficiencies, and (2) Project (design) a concrete or steel building with earthquake resistant qualities. Both exercises should be solved in groups of three or four people; It is recommended that these groups be as heterogeneous as possible, mixing architects with engineers, Spaniards with foreigners, people with and without professional experience, etc. In any case, it is required that no group be made up exclusively of architects who have studied at foreign universities or only of engineers. The solved exercises will be defended in public session by all their authors. The defense of the first and second exercises will be scheduled in the middle and end of the school period, respectively. The rating will be the arithmetic mean of that of both exercises. Students who do not pass the pass may take the extraordinary exam; in any case, students who have passed and want to raise their grade may also take it.

Extraordinary examination. Individual written test on the syllabus of the subject.

EXAMINATION RULES.

If some of the evaluation activities are not done, they will be considered as non-marked.

BIBLIOGRAPHY

Basic:

- Charleson, Andrew. Seismic Design for Architects: Outwitting the Quake. Elsevier, 2008. ISBN 9780750685504.
- Dowrick, David J.. Earthquake resistant design for engineers and architects. 2a ed.. Chichester [etc.]: John Wiley and Sons, 1987. ISBN 0471915033.
- Ambrose, James E.; Vergun, Dimitry. Diseño simplificado de edificios para cargas de viento y sismo. Mexico: Limusa, 1986. ISBN 9681818032.
- European Committee for Standardization. Eurocode 8: Design of structures for earthquake resistance - [on line]. 2004 Available on: <https://www.phd.eng.br/wp-content/uploads/2015/02/en.1998.1.2004.pdf>.
- Aenor. Anejo Nacional AN/UNE-EN 1998-1 [on line]. 2017. Aenor, 2017 Available on: <https://www.fomento.gob.es/NR/rdonlyres/DE08DF70-CACE-4C60-9333-D4C96C75C878/142562/ANUNEEN19986partes1.pdf>.

Complementary:

- Norma de construcción sismorresistente : NCSE-02. Madrid: Liteam, 2002. ISBN 8495596350.