

Course guide

250243 - CONPONALES - Construction of Bridges and Other Structures

Last modified: 22/05/2024

Unit in charge: Barcelona School of Civil Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering.

Degree: BACHELOR'S DEGREE IN PUBLIC WORKS ENGINEERING (Syllabus 2010). (Optional subject).

Academic year: 2024 **ECTS Credits:** 6.0 **Languages:** Spanish

LECTURER

Coordinating lecturer: GONZALO RAMOS SCHNEIDER

Others: JUAN RAMON CASAS RIUS, ALBERTO DE LA FUENTE ANTEQUERA, GONZALO RAMOS SCHNEIDER, IGNACIO SEGURA PEREZ, JOSE TURMO CODERQUE

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

- 3082. Ability to construct, conserve, dimension and design roads and the items comprising basic road provision
- 3083. Ability to construct and conserve railway lines with knowledge of the application of the specific technical regulations, differentiating the characteristics of the rolling stock
- 3084. Ability to use the appropriate construction procedures, construction machinery and planning techniques in carrying out works

Generical:

- 3105. Students will learn to identify, formulate and solve a range of engineering problems. They will be expected to show initiative in interpreting and solving specific civil engineering problems and to demonstrate creativity and decision-making skills. Finally, students will develop creative and systematic strategies for analysing and solving problems.
- 3106. Students will learn to assess the complexity of the problems examined in the different subject areas, identify the key elements of the problem statement, and select the appropriate strategy for solving it. Once they have chosen a strategy, they will apply it and, if the desired solution is not reached, determine whether modifications are required. Students will use a range of methods and tools to determine whether their solution is correct or, at the very least, appropriate to the problem in question. More generally, students will be encouraged to consider the importance of creativity in science and technology.
- 3107. Students will learn to identify, model and analyse problems from open situations, consider alternative strategies for solving them, select the most appropriate solution on the basis of reasoned criteria, and consider a range of methods for validating their results. More generally, students will learn to work confidently with complex systems and to identify the interactions between their components.
- 3111. Students will learn to plan, design, manage and maintain systems suitable for use in civil engineering. They will develop a systematic approach to the complete life-cycle of a civil engineering infrastructure, system or service, which includes drafting and finalising project plans, identifying the basic materials and technologies required, making decisions, managing the different project activities, performing measurements, calculations and assessments, ensuring compliance with specifications, regulations and compulsory standards, evaluating the social and environmental impact of the processes and techniques used, and conducting economic analyses of human and material resources.
- 3112. Students will develop an understanding of the different functions of engineering, the processes involved in the life-cycle of a construction project, process or service, and the importance of systematising the design process. They will learn to identify and interpret the stages in preparing a product design specification (PDS), draft and optimise specifications and planning documents, and apply a systematic design process to the implementation and operation phases. Students will learn to write progress reports for a design process, use a range of project management tools and prepare final reports, and will be expected to show an awareness of the basic economic concepts associated with the product, process or service in question.
- 3113. Students will learn to identify user requirements, to draft definitions and specifications of the product, process or service in question, including a product design specification (PDS) document, and to follow industry-standard design management models. Students will be expected to show advanced knowledge of the steps involved in the design, execution and operation phases and to use the knowledge and tools covered in each subject area to the design and execution of their own projects. Finally, students will assess the impact of national, European and international legislation applicable to engineering projects.

Transversal:

586. ENTREPRENEURSHIP AND INNOVATION - Level 2. Taking initiatives that give rise to opportunities and to new products and solutions, doing so with a vision of process implementation and market understanding, and involving others in projects that have to be carried out.

589. SUSTAINABILITY AND SOCIAL COMMITMENT - Level 2. Applying sustainability criteria and professional codes of conduct in the design and assessment of technological solutions.

594. TEAMWORK - Level 3. Managing and making work groups effective. Resolving possible conflicts, valuing working with others, assessing the effectiveness of a team and presenting the final results.

584. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.

TEACHING METHODOLOGY

The course consists of 1.6 hours per week of classroom activity (large size group) and 1.3 hours weekly with half the students (medium size group).

The 1.6 hours in the large size groups are devoted to theoretical lectures, in which the teacher presents the basic concepts and topics of the subject, shows examples and solves exercises.

The 1.3 hours in the medium size groups is devoted to solving practical problems with greater interaction with the students. The objective of these practical exercises is to consolidate the general and specific learning objectives.

The rest of weekly hours devoted to laboratory practice.

Support material in the form of a detailed teaching plan is provided using the virtual campus ATENEA: content, program of learning and assessment activities conducted and literature.

Although most of the sessions will be given in the language indicated, sessions supported by other occasional guest experts may be held in other languages.

LEARNING OBJECTIVES OF THE SUBJECT

Students will acquire an understanding of the construction of bridges and other structures.

Civil construction pathway

History of the art of building bridges; Bridge superstructure; Forces in highway and railway bridges; Types of bridges: beam bridges, frame bridges, arch bridges, cable-stayed bridges; Organisation of cross sections: girder bridges, slab bridges, box girder bridges; Bridge supports; Bridge building procedures; In-situ construction; Prefabrication; Span-by-span construction; Incremental launching construction; Progressive cantilever construction; Lateral displacement, rotation and transverse reinforcement; Construction of other structures; Construction under adverse conditions; Construction of foundation elements and other projects directly related to the land (cables, tunnels, walls, etc.); Unusual concrete structures (elevated tanks, towers, sheets, etc.); Unusual metal structures (tall buildings, towers, roofs, etc.); Demolition techniques; Degree of industrialisation of construction; Prefabricated vs. in-situ construction; Quality in construction; Construction vs. the environment

Historical summary of the art of building bridges. Superstructure equipment. Actions on road bridges. Types of bridges: straight section bridges, beam bridges, arch bridges, suspension bridges. Organization of the cross section: beam bridges, slab bridges, box-girder section. Bridge bearings. Bridge construction methods. On-site construction. Prefabrication. Span-by-span construction. Incremental launching construction. Construction by balanced cantilevers. Translation, rotation and pushing. Construction of other structures: structures with 3D concrete, with fiber concrete, sprayed concrete and dam construction

STUDY LOAD

Type	Hours	Percentage
Self study	84,0	56.00
Hours large group	30,0	20.00
Hours small group	15,0	10.00
Guided activities	6,0	4.00
Hours medium group	15,0	10.00

Total learning time: 150 h

CONTENTS

General Topics

Description:

Platforms road and rail

Full-or-part-time: 4h 48m

Theory classes: 2h

Self study : 2h 48m

Equipment superstructure

Description:

Platforms road bridges. Platforms for railway bridges. pPataformes pasasrelas for pedestrian

Safety equipment: pretils and Barañain. Drainage. Il·luminació. Juntas of road

Full-or-part-time: 9h 36m

Theory classes: 2h

Practical classes: 2h

Self study : 5h 36m

Actions to consider about bridges

Description:

Actions to consider about bridges masks. Actions to be considered on the railway bridge

Full-or-part-time: 4h 48m

Theory classes: 2h

Self study : 2h 48m

Longitudinal static schemes

Description:

Bridges beam (straight section). Ponts Gantry

Bridges arch. Bridges tank

Full-or-part-time: 9h 36m

Theory classes: 4h

Self study : 5h 36m

Types of cross section of bridge decks

Description:

Panels of reinforced concrete bridges. Panels section Llosa
Panels bridge beams. Panels bridge drawer. Panels, metal and mixed bridges

Full-or-part-time: 9h 36m

Theory classes: 4h

Self study : 5h 36m

Piers and Abuttements

Description:

Tipologias second battery on board. Batteries higher. Aspects of computing. Type of Footsteps. Aspects of design and computation

Full-or-part-time: 4h 48m

Theory classes: 2h

Self study : 2h 48m

Bearing devices

Description:

Assistive devices for concrete and metal. Assistive devices such as "POT"
Bearing devices of neoprene
Structural analysis of bridges in front of horizontal actions

Full-or-part-time: 14h 23m

Theory classes: 4h

Practical classes: 2h

Self study : 8h 23m

Construction procedure of bridge decks

Description:

Construction of boards beams: fabrication and assembly of the beams
Construction of bridge decks "in situ" on falsework resting on the floor
Construction section to section. Building momentum for the board. Rotate the board.
Cantilever constructions of bridge girders

Full-or-part-time: 19h 12m

Theory classes: 8h

Self study : 11h 12m

Recaps

Description:

Criteria for selection of static diagrams and cross sections
Criteria of choice of a constructive procedure
Criteria of choice of bearing devices

Full-or-part-time: 14h 23m

Practical classes: 6h

Self study : 8h 23m

Construction of other structures

Description:

Concrete Construction. Theoretics aspects
Concrete Construction. Practical aspects
High Performance Concretes
Autocompacted concrete
Concrete fibers
Concrete for Dams. Projectec concrete
Case studies

Full-or-part-time: 33h 36m

Theory classes: 10h

Practical classes: 4h

Self study : 19h 36m

Evaluation of Construction of others structures

Full-or-part-time: 4h 48m

Laboratory classes: 2h

Self study : 2h 48m

Evaluation of Bridges Construction

Full-or-part-time: 14h 23m

Laboratory classes: 6h

Self study : 8h 23m

GRADING SYSTEM

The evaluation tests consist of a part with questions about concepts associated with the learning objectives of the course with regard to knowledge or understanding, and a part with a set of application exercises.

For this course will be held 3 assessments:

- Assessment 1 (part of Bridge Construction): weight 35% of the total mark
- Assessment 2 (part of Bridge Construction): weight 40% of the total mark
- Assessment 3 (part of Construction of other structures): weight 25% of the total mark

Assessments 2 and 3 will be the same day.

Criteria for re-evaluation qualification and eligibility: Students that failed the ordinary evaluation and have regularly attended all evaluation tests will have the opportunity of carrying out a re-evaluation test during the period specified in the academic calendar. Students who have already passed the test or were qualified as non-attending will not be admitted to the re-evaluation test. The maximum mark for the re-evaluation exam will be five over ten (5.0). The non-attendance of a student to the re-evaluation test, in the date specified will not grant access to further re-evaluation tests. Students unable to attend any of the continuous assessment tests due to certifiable force majeure will be ensured extraordinary evaluation periods.

These tests must be authorized by the corresponding Head of Studies, at the request of the professor responsible for the course, and will be carried out within the corresponding academic period.



BIBLIOGRAPHY

Basic:

- Chen, W.F.; Duan, L. Bridge engineering handbook. 2nd ed. Boca Raton ; New York: CRC Press, 2014. ISBN 9781439852088.
- Calgaro, J.A. Projet et construction des ponts : généralités, fondations, appuis, ouvrages courants. 3e éd. Paris: Presses de L'Ecole Nationales des Ponts et Chaussées, 2000. ISBN 9782859783273.
- Manterola, J. Puentes: apuntes para su diseño, cálculo y construcción. Madrid: Colegio de Ingenieros de Caminos,, 2006. ISBN 9788438003237.