Course guide
2500038 - GECCTPONTS - Construction of Bridges and Other Structures

Last modified: 01/10/2023

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

Degree: BACHELOR'S DEGREE IN CIVIL ENGINEERING (Syllabus 2020). (Optional subject).

Academic year: 2023 **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:
14406. Ability to analyze the problem of safety and health in construction sites. (Common module to the Civil branch)
14410. Knowledge of the typology and calculation bases of prefabricated elements and their application in manufacturing processes. (Specific technology module: Civil Construction)
14411. Knowledge about the project, calculation, construction and maintenance of building works in terms of structure, finishes, facilities and own equipment. (Specific technology module: Civil Construction)
14415. Ability to apply construction procedures, construction machinery and construction planning techniques. (Specific technology module: Civil Construction)

Generical:
14380. Scientific-technical training for the exercise of the profession of Technical Engineer of Public Works and knowledge of the functions of advice, analysis, design, calculation, project, construction, maintenance, conservation and exploitation.
14383. Ability to project, inspect and direct works, in their field.
14386. Capacity for maintenance, conservation and exploitation of infrastructure, in its field.
14390. Identify, formulate and solve engineering problems. Pose and solve construction engineering problems with initiative, decision-making skills and creativity. Develop a systematic and creative method of analysis and problem solving. (Additional school competition).
14391. Conceive, project, manage and maintain systems in the field of construction engineering. Cover the entire life cycle of an infrastructure or system or service in the field of construction engineering. (Additional school competition).

TEACHING METHODOLOGY

The course consists of 4 hours per week of classroom activity

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

Construction of bridges. History of bridges, actions, equipments, longitudinal and transversal typologies, supports and constructive procedures. Construction of other structures. Structures with special concrete, constructive procedures of singular structures.

1 Ability to identify the different types of bridges and understand their construction procedures for their various elements both in situ and prefabricated.
2 Capacity for the construction of foundation elements and other works directly related to the land, singular concrete constructions and singular metallic constructions.
3 Ability to define demolition techniques and understand the relations between construction and environment.

Historical summary of the art of building bridges. Equipment of the superstructure. Actions on roads and railway bridges. Bridge typologies: straight span bridges, gantry bridges, arch bridges, cable-stay bridges. Organization of the cross section: beam bridges, slab bridges, box section. Bridge supports. Bridge construction procedures. On-site construction. Prefabrication. Span-to-span construction. Push construction. Construction by successive cantilevers. Ripping, rotation and cross thrust. Construction of other structures. Construction in adverse situations. Construction of foundation elements and other works directly related to the soil (braces, tunnels, screens, etc.). Unique concrete constructions (elevated tanks, towers, lamina, etc.). Unique constructions of steel structures (high-rise buildings, towers, roofs, etc.). Demolition techniques of works. The degree of industrialization of construction. Precast construction vs. on-site construction. The quality in construction. Construction versus 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
Hours medium group	30,0	20.00
Hours large group	30,0	20.00
Self study	84,0	56.00
Guided activities	6,0	4.00

Total learning time: 150 h

CONTENTS

Bridges

Description:
Presentation, terminology and current situation of Bridge Construction
Platform for road bridges. Platform for railway bridges. Platform for pedestrian walkways. Pavements on road bridge decks.
Safety equipment: stands and railings. Drainage system. Lightning. Roadway Joints
Actions to consider on road bridges. Actions to consider on railway bridges.
Loads to consider in Bridges
Beam decks, frame bridges, arches, cable supported bridges. Types of support devices and their characteristics.
Static Schemes. Support Devices
Isostatic and continuous decks, frames
Beams. Frames
Structural system. Examples
Arch bridges. Cable-stayed and Suspended
Precast beam decks, slab decks, box girders, composite and steel decks
Beams, slabs and box girders
Types of pier according to the deck. High piers. Types of abutments. Design.
Piers and Abutments. Typologies. Behavior
Construction methods of piers and abutments
Piers and Abutments. Construction
Construction of precast bridge decks. Mounting by crane, beam launcher, lifting, ...
Construction by crane. Beams
Construction on lasework over the entire length and construction span by span, on lasework or with self-launching falswork. Postensioning
Construction on falsework. Postensioning
Construction procedure and auxiliary means for the construction of decks and cantilevered arches
Construction procedures and auxiliary means
Construction procedures and auxiliary means
Criteria for choosing static diagrams and cross sections
Criteria for choosing construction procedures
Criteria for choosing bearings
Evaluation

Full-or-part-time: 100h 48m
Theory classes: 25h
Practical classes: 17h
Self study : 58h 48m

Construction of Other Structures

Description:
Construction Procedures for Dams, Buildings, Unique Elements
Construction procedures, auxiliary means and applications.
Construction with Special Concrete. Sprayed. Fibers, Self-compacting
Construction of Other Structures. Dams

Full-or-part-time: 43h 12m
Theory classes: 8h
Practical classes: 8h
Laboratory classes: 2h
Self study : 25h 12m

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. 3e éd. Paris: Presses de L'Ecole Nationale 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.
- Arenas, J.J.; Aparicio, A.C. Aparatos de apoyo para puentes y estructuras. Santander: Universidad. E.T.S. de Ingenieros de Caminos, Canales y Puertos. Cátedra de Puentes, 1980. ISBN 8460022439.

Complementary:
- Leonhardt, F. Ponts: l'esthétique des ponts = Puentes: estética y diseño. Lausanne: Presses Polytechniques Romandes, 1986. ISBN 2880740991.
- Hambly, E.C. Bridge deck behaviour. 2nd ed. New York: Chapman and Hall, 1991. ISBN 0419172602.