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250474 - GESTESTRU - Structural Management

Coordinating unit: 250 - ETSECCPB - Barcelona School of Civil Engineering

Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering

Academic year: 2015

Degree: MASTER'S DEGREE IN CIVIL ENGINEERING (PROFESSIONAL TRACK) (Syllabus 2012). (Teaching unit Optional)
MASTER'S DEGREE IN CIVIL ENGINEERING (RESEARCH TRACK) (Syllabus 2009). (Teaching unit Optional)
MASTER'S DEGREE IN STRUCTURAL AND CONSTRUCTION ENGINEERING (Syllabus 2009). (Teaching unit Optional)
MASTER'S DEGREE IN STRUCTURAL AND CONSTRUCTION ENGINEERING (Syllabus 2015). (Teaching unit Optional)

ECTS credits: 5 Teaching languages: Catalan, Spanish

Teaching staff

Coordinator: JUAN RAMON CASAS RIUS

Others: VICENTE ALEGRE HEITZMANN, JUAN RAMON CASAS RIUS

Opening hours

Timetable: Thursday from 16.00 to 18.00

Degree competences to which the subject contributes

Specific:

8162. Knowledge of all kinds of structures and materials and the ability to design, execute and maintain structures and buildings for civil works.

8228. Knowledge of and competence in the application of advanced structural design and calculations for structural analysis, based on knowledge and understanding of forces and their application to civil engineering structures. The ability to assess structural integrity.

Teaching methodology

The course consists of 1,8 hours per week of classroom activity (large size group) and 0,8 hours weekly with half the students (medium size group).

The 1,8 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 0,8 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.

Learning objectives of the subject

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Specialization subject in which knowledge on specific competences is intensified.

Knowledge and skills at specialization level that permit the development and application of techniques and methodologies at advanced level.

Contents of specialization at master level related to research or innovation in the field of engineering.

Knowledge regarding the correct performance of the structure in the service life, ie, all those aspects that arise once the structure has been built and put into service. Define the concepts that allow a good durability and appropriate management of this structure given the progressive deterioration of materials and the variation of the imposed actions

Study load

Total learning time: 125h	Theory classes:	19h 30m	15.60%
	Practical classes:	9h 45m	7.80%
	Laboratory classes:	9h 45m	7.80%
	Guided activities:	6h	4.80%
	Self study:	80h	64.00%

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Content

Inspection of structures

Learning time: 28h 47m

Theory classes: 12h
Self study : 16h 47m

Description:

Definitions, justification and objectives. Concepts of safety and service life. Standards of structural safety: minimum, optimum and acceptable. Steps in the management of structures: inventory, inspection and assessment, diagnoses and decision. Concept of condition state and methods of evaluation (condition index). Definition and concept of defect. Classification and significance: Structural and functional defects. Most common defects according to material and structural type: retaining walls, building structures, hydraulic works. Mapping of cracks. Classification and quantification of defects in concrete structures.
Mechanisms of deterioration in concrete. Physical Processess: cracking, frost and thaw, erosion. Chemical processess: acid atack, sulphate atack, alkali-silica reaction. Biological Processess. The particular case of degradation in the aluminous cement. Degradation mechanisms in reinforcing and prestressing steels. Models for prediction in structural concrete and steel. Protection mechanisms in front of corrosion.
Tests on concrete. Non-destructive testing and semi-destructive. Description of tests. Most commonly used tests: theory, calibration and interpretation. Reliability, limitations and applications. Criteria for selecting the type of test: durability, concrete strength, and comparative trials. Interpretation of results: variability of the properties, reliability of test methods, confidence intervals. Tests in structural steel: visual inspection, ultrasonic, dye penetrant, radiography, acoustic emission. Extent of cracking.
Structural tests. Load testing of structures in service. Information obtained and utility. Advantages and disadvantages compared to materials testing.

Specific objectives:

To introduce students the concepts that are part of the subject relating to inspection, maintenance, evaluation and repair of existing structures
Students learn the major defects that appear on the structures and their causes, taking into account the material, type of structure and phases where the problem originated (design or execution). To learn how to assess the importance of a defect or damage in the serviceability and safety of the structure
Once considered the most frequent defects in the structures in the class above, the objective is to know which are the mechanisms that lead to these defects. Showing the most used theoretical models for the modeling of degradation of structural materials
Description of the methods of inspection of existing structures. Scope. Provide criteria for proper decision on the most appropriate method to apply.

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Structural assessment

Learning time: 28h 47m

Theory classes: 11h
Laboratory classes: 1h
Self study : 16h 47m

Description:

Definition and justification. Principles and philosophy of structural assessment. Objectives and methods of the structural assessment. Sources of uncertainty. Differences between design and assessment. Concept of structural safety. Quantification of structural safety. Types of evaluation: deterministic and probabilistic. Phases of the evaluation. Assessment methods: deterministic and probabilistic. Advantages and disadvantages.
Description of evaluation methods based on structural reliability. Concept of reliability index. Definition and concept of the limit state function. Methods for calculating the probability of failure or reliability index: simulation methods, approximate methods (FOSM, FORM, SORM).
Statistical models of structural steel strength: yield strength, modulus of elasticity. Statistical models of concrete: compressive strength, ultimate strain, ... Statistical models of reinforcing and prestressing steel: yield strength, modulus of elasticity, ultimate strain. Statistical models of structural response. Statistical models for loads: permanent and variable loads, live load, ...
Illustrate through real examples the aplication of advanced methods for structural assessment.

Specific objectives:

Show students the concepts and methods of structural assessment, by comparing them with the concepts and methods used in the design of new structures
Provide the necessary information for the student to carry out a probabilistic assessment

Repair and strengthening of structures

Learning time: 36h

Theory classes: 13h
Laboratory classes: 2h
Self study : 21h

Description:

Jacketing methods for strengthening elements in compression and bending as well as other methods of flexural reinforcement
Formulation of the general principles of structural strengthening by adding forces (external prestressing) and composite materials (FRP)
Technical maintenance and repair of concrete pavements. Repair of cracks. Repair of joints. Calculation of thickness of the reinforcement
Most common damages and defects in concrete bridges, steel or masonry. Examples of bridges with structural and durability problems and proposals for strengthening

Qualification system

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Regulations for carrying out activities

Failure to perform a continuous assessment activity in the scheduled period will result in a mark of zero in that activity.

Bibliography

Basic:

Calavera Ruiz, J. Patología de estructuras de hormigón armado y pretensado. 2a ed. Madrid: INTEMAC, 2005. ISBN 8488764219.

Schneider, J.. Introduction to Safety and Reliability of Structures. Zurich: IABSE, 1997.

Melchers, R.E.. Structural Reliability. Analysis and prediction. Primera. Chichester: Ellis Horwood Series in Civil Engineering, 1987.

GEHO-ATEP. Reparación y refuerzo de estructuras de hormigón: guía FIP de buena práctica. Madrid: Colegio de Ingenieros de Caminos, Canales y Puertos, 1994. ISBN 8438000797.

GEHO. Durabilidad de estructuras de hormigón. Guia de diseño CEB. Madrid: GEHO-Colegio Ingenieros de Caminos, Canales y Puertos, 1993.

Complementary:

Dirección General de Carreteras. Guía de inspecciones básicas de obras de paso. Madrid: Ministerio de Fomento, 2009.

Casas, J.R.. La enseñanza de la gestión de estructuras: una necesidad. Barcelona: Colegio de Ingenieros de Caminos, Canales y Puertos, 1999.

Dirección General de Carreteras. Inspecciones principales de puentes de carretera. Madrid: Ministerio de Fomento,

Task Group 5.6. Model Code for Service Life Design. Lausanne: FIB, 2006.