INSTITUTO POLITÉCNICO DE BRAGANÇA

Course Unit	Construction Materials			Field of study	Tecnology and Construction Materials		
Bachelor in	Civil Engineering			School	School of Technology and Management		
Academic Year	2022/2023	Year of study	2	Level	1-2	ECTS credits	6.0
Type	Semestral	Semester	1	Code	9089-322-2103-00-22		

Workload (hours)	162	Contact hours	T	TP	PL	TC	S	E	OT	O
			30	24	6	-	-	-	-	-

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s): Eduarda Cristina Pires Luso

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
1. Understand and recognize the material requirements and planning on the construction site;
2. Classify the different building materials, understand its basic structure and limitations of use;
3. Execute the control of quality of some of the most important building materials and promote conformity criteria;

Prerequisites

Before the course unit the learner is expected to be able to:
1. Execute basic calculus of mathematics and statistics;
2. Understand general concepts of mechanics of materials (tensile and compressive strengths, etc.)
3. Convert units on the international system.

Course contents

Classification and behaviour of building materials: Natural stone; Aggregates; Timber; Steel; Binders; Mixing water; Additives; Mortars; Concrete; Ceramic materials, Polymers, Paints and Varnishes.

Course contents (extended version)

1. CLASSIFICATION AND BEHAVIOUR OF BUILDING MATERIALS
   - Building materials - general approach;
   - Behaviour and classification of building materials;
   - Mechanics of Materials revision.
2. NATURAL STONE
   - Classification, physical and mechanical properties;
   - Laboratory tests;
3. AGGREGATES
   - Classification, physical and mechanical properties;
   - Determination of particle size distribution (sieving method) and mixture of aggregates;
   - Laboratory tests: Los Angeles, Particle size distribution, etc. Standard NP EN 12620.
4. TIMBER
   - Composition and main properties;
   - Laboratory tests: Portuguese and European standardisation - EC5;
   - Defects and anomalies;
   - Wood-based materials and their properties.
5. STEEL
   - Types and manufacturing of steel;
   - Physical and mechanical properties;
   - Protection against oxidation and fire;
   - Other metals (aluminum, lead, zinc and copper).
6. BINDERS
   - Classification;
   - Manufacturing and main properties;
   - Laboratory tests: Standards ENV 459, EN 196, NP 2064, NP 2065, ENV 197.
7. MIXING WATER, ADDITIVES AND ADMIXTURES
   - Determination of mixing water for mortars and concrete, using Expedito, Bolomey and Faury Methods.
   - Study of the various additives and admixtures.
   - Testing standards. Requirements and conformity criteria.
8. MORTARS
   - Composition and properties.
9. CONCRETE
   - Composition and manufacture of concrete;
   - Concrete composition: Faury, Valette and Leclerc du Sablon Methods;
   - Types and classification of concrete;
   - Main pathologies of simple concrete and reinforced concrete;
   - Standards tests: NP EN 206-1, NP EN 13670-1, EN 12350, etc.
10. COMPOSIT AND AGGLOMERATED MATERIALS, POLYMERS AND PAINTS
    - Composition and properties.
11. CERAMIC MATERIALS
    - Manufacture, properties and applications;
    - Testing standards: NP 80, NP 52, NP 308, etc.

Recommended reading

1. Bauer F. , 1994 – Materiais de Construção, Volumes I e II, Livros Técnicos e Científicos Editora, Rio de Janeiro, Brasil.
2. Hirt Manfred A. , 1994 – Construction Métallique, Traité de Génie Civil de l'École Polytechnique Fédérale de Lausanne, Volume 10.
3. Sebenta de Materiais de Construção, Autor: Eduarda Luso, Escola Superior de Tecnologia e Gestão do Instituto Politécnico de Bragança.
4. Natterer et al. , 1987 – Construire en Bois, Presses Polytechniques Romandes.
5. Coutinho, A. Sousa, 1994 – Composição e Fabrico do Betão, Volumes I, II e III, Lisboa, LNEC.

Teaching and learning methods

The unit will be taught using a combination of expository lectures, practice lessons, laboratory tests and self guided learning. Students will be provided with a study guide and support material, including e-learning facilities.

Assessment methods

1. Alternative 1 - (Regular, Student Worker) (Final, Supplementary, Special)
   - Experimental Work - 20%
   - Final Written Exam - 80%
2. Alternative 2 - (Student Worker) (Final, Supplementary, Special)
   - Final Written Exam - 100%

Language of instruction

Portuguese, with additional English support for foreign students.

Electronic validation

Eduarda Cristina Pires Luso	Jorge Pedro Lopes	António Miguel Verdelho Paula	Paulo Alexandre Vara Alves
11-10-2022	12-10-2022	24-10-2022	24-10-2022