

Course unit title:	Construction Materials		
Course unit code:	CE205		
Type of course unit:	Compulsory		
Level of course unit:	Bachelor (1st Cycle)		
Year of study:	2		
Semester when the unit is delivered:	3 (Fall)		
Number of ECTS credits allocated :	5		
Name of lecturer(s):	Dr. Demetris Nicolaides		
Learning outcomes of the course unit:	<ol style="list-style-type: none"> <li>1. Identify the basic construction materials and their applications, describe the physical and mechanical properties of construction materials and analyse the atomic structure of materials.</li> <li>2. Describe the concept of Hydraulic Cements, give emphasis to Portland cement, and evaluate the factors that affect the strength of Hardened Cement Paste. Also describe the types of aggregates and the most common classification methods.</li> <li>3. Define concrete constituent materials, analyse the properties of fresh and hardened concrete, describe the most common tests, and evaluate the chemical admixtures used in concrete technology.</li> <li>4. Describe the principles of concrete mix design for the achievement of specific strength and durability requirements.</li> <li>5. Describe the types of metals used in construction industry, analyse fundamental properties of metals and describe the most common tests of steel. Evaluate steel as concrete reinforcement and structural material, and describe aluminium properties and alloys, and analyse their applications.</li> <li>6. Describe the types of timber the most common classification methods, and explain the properties of timber and describe the most common tests.</li> <li>7. Describe the primary masonry materials used in construction, analyse the properties of stone, bricks and concrete masonry units, and the most common classification methods.</li> <li>8. Describe the recent trends of research in construction materials, the applications of modern construction materials, and analyse the importance of the development and use of sustainable construction materials.</li> <li>9. Explain the concept of composite materials; describe their mechanical and durability advances and list examples and applications of composite construction materials (UHPFRCCs and FRPs).</li> </ol>		
Mode of delivery:	Face-to-face		
Prerequisites:		Co-requisites:	None
Recommended optional program components:			
Course contents:	<p><b>Introduction:</b> Basic construction materials and their applications. Most common ways of materials loading. Basic units used in the material science.</p> <p><b>Material Properties:</b> Physical, mechanical and chemical properties of construction materials. Terms of Bearing Capacity, Density, Specific Gravity and Modulus of Elasticity. Principle of the probabilistic assessment of properties. Atomic structure of materials. Types of atomic bonds and special lattices. Terms of micro- and macro-structures.</p> <p><b>Cements:</b> Concept of Hydraulic Cements and give emphasis to Portland cement. Process of manufacture of Portland cement. Chemical composition of Portland cement. Process of hydration of cement. Structure of Hardened Cement Paste (HCP). Factors that affect the strength of Hardened Cement Paste.</p> <p><b>Aggregates:</b> Types of aggregates and the most common classification methods. Role of their shape and texture in the properties of a concrete mix. Evaluate their role as fillers. Terms of size gradation, sieve analysis and grading curves. Strength</p>		

	<p>and durability of aggregates and most common tests.</p> <p><b>Concrete:</b> Concrete constituent materials. Properties of fresh and hardened concrete and most common tests. Chemical admixtures used in concrete technology. Principles of developing High Strength Concrete mixtures. Durability principles and durability properties of concrete. Testing procedures of fresh and hardened material on site. Concrete mix design for the achievement of specific strength and durability requirements. Concrete applications.</p> <p><b>Metals:</b> Types of metals used in construction industry. Properties of metals and most common tests of steel. Steel as concrete reinforcement and steel as a structural material. Durability issues of steel and maintenance methods. Aluminium properties and alloys, and their applications.</p> <p><b>Timber:</b> Types of timber and most common classification methods. Properties of timber and most common tests. Applications of timber as a structural material. Durability issues of timber and the required maintenance applications. Principles of timber processing in order to be used as a construction material.</p> <p><b>Masonry:</b> Primary masonry materials used in construction. Properties of stone and the most common classification methods. Properties of bricks and the most common classification methods. Properties of concrete masonry units (CMU) and the most common classification methods. Advantages and disadvantages of masonry construction and the structural behaviour. Properties of masonry materials and the most common testing methods.</p> <p><b>Introduction to Modern Materials:</b> Recent trends of research in construction materials. Applications of modern construction materials. Importance of the development and use of sustainable construction materials.</p> <p><b>Modern Composite Construction Materials:</b> Analyse the importance of composite materials in construction industry. Explain the fundamental terminology of composite materials. Specify the mechanical and durability advances of specific composite materials (UHPFRCCs and FRPs). Provide examples and applications of composite construction materials (UHPFRCCs and FRPs).</p>
Recommended and/or required reading:	
Textbooks:	“Construction Materials: Their Nature and Behaviour”, Fifth Edition, edited by Marios Soutsos, Peter Domone, CRC Press; 2017.
References:	<p>“Properties of Concrete”, Fifth Edition, Adam Neville, Pearson, 2011.</p> <p>“Design and Control of Concrete Mixtures”, 16<sup>th</sup> Edition, PCA, 2016.</p> <p>“Δομικά Υλικά”, Αθανάσιος Χ. Τριανταφύλλου, 2013.</p>
Planned learning activities and teaching methods:	The course is delivered through theoretical lectures in class and experimental work in civil engineering laboratory. The lectures present to the student the course content and allow for questions. Part of the material is presented using visual aids. The aim is to familiarize the student with the different and faster pace of presentation and also allow the instructor to present related material (photographs, videos, etc.). The learning process is enhanced with the requirement from the student to solve relevant examples. Besides from the notes taken by students in class, all of the course material is available through the class website and also through e-learning platform. Finally the instructor is available to students during office hours or by appointment in order to provide any necessary tutoring.
Assessment methods and criteria:	<ul style="list-style-type: none"> <li>• Coursework 30%</li> <li>• Laboratory Work: 20%</li> <li>• Final Exam 50%</li> </ul>
Language of instruction:	English
Work placement(s):	No