

<b>Course unit title:</b>	<b>Sustainable Construction Materials</b>		
<b>Course unit code:</b>	<b>CESU213</b>		
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 Nicolaidis		
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 types of metals used in construction industry, analyse the properties of metals and describe the most common tests of steel. Evaluate steel as concrete reinforcement and steel as a structural material, and describe aluminium properties and alloys, and analyse their applications.</li> <li>5. Describe the types of timber the most common classification methods, and explain the properties of timber and describe the most common tests.</li> <li>6. 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>7. Analyse the constituent materials of bituminous mixes, describe the properties of bituminous mixes in their fresh and hardened state, and describe the testing methods of fresh and hardened material.</li> </ol>		
Mode of delivery:	Face-to-face		
Prerequisites:		Co-requisites:	None
Recommended optional program components:			
Course contents:	<p><b><u>Introduction:</u></b> Basic construction materials and their applications. Most common ways of materials loading. Basic units used in the material science.</p> <p><b><u>Material Properties:</u></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><u>Cements:</u></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><u>Aggregates:</u></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 and durability of aggregates and</p>		

	<p>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. 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.</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>Bituminous:</b> Constituent materials of bituminous mixes. Properties of bituminous mixes in their fresh and hardened state. Durability issues of bituminous materials. Testing methods of fresh and hardened material. Methods of production and principles of mix design. Fundamental applications of bituminous materials.</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>
Recommended and/or required reading:	
Textbooks:	“Construction Materials: Their Nature and Behaviour”, edited by Illston and Domone, Spon Press; 1994.
References:	<p>“Civil Engineering Materials”, Jackon and Dhir, Palgrave Publishers, 1996.</p> <p>“Properties of Concrete”, Neville, Longman, 1997.</p> <p>“Δομικά Υλικά”, Α.Χ. Τριανταφύλλου, Εκδόσεις Παπασωτηρίου, 2008.</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.
Assessment methods and criteria:	<ul style="list-style-type: none"> <li>• Assignments 10%</li> <li>• Tests: 15%</li> <li>• Laboratory Work: 15%</li> <li>• Final Exam 60%</li> </ul>
Language of instruction:	English
Work placement(s):	No

Course unit title:	<b>Green Building Materials</b>		
Course unit code:	<b>CESU 410</b>		
Type of course unit:	Elective		
Level of course unit:	Bachelor		
Year of study:	3		
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. Ability to understand the concept of sustainability in relation to the building materials and capacity to apply sustainability in civil engineering practice.</li> <li>2. Ability to understand the principles of Life Cycle Assessment and use the outcome of LCA for the selection of green construction materials.</li> <li>3. Capacity to identify, explain and evaluate materials specification for the development of a greener structure.</li> <li>4. Capacity to analyse and adopt rules for selection of greener materials.</li> <li>5. Ability to understand and apply methods for the minimisation of the environmental impact of most common building materials and also identify potential applications.</li> </ol>		
Mode of delivery:	Face-to-face		
Prerequisites:	CEM213	Co-requisites:	None
Recommended optional program components:			
Course contents:	<p><b>Overview of Civil Engineering materials:</b> Revise of essential information related to Material properties, Material markets, Material flow, Embodied and process energies of materials, Impact on the Biosphere, Optimization of material use, Responsible sourcing.</p> <p><b>Concept of Sustainability:</b> Explain the fundamental terminology related Sustainability, analyse the most important definitions and impacts and finally explain building materials Life-Cycle concerns.</p> <p><b>Sustainable Civil Engineering Design Practice:</b> Analyse the existing policies on the role of the Engineer in Sustainability, present other guidelines for sustainable design and sustainability metrics for materials and explain what goes into our buildings.</p> <p><b>Life-Cycle Assessment (LCA) and Green Materials:</b> Introduction to life-cycle assessment and explain the principles of selection of building materials using LCA.</p> <p><b>Material Specifications:</b> Explain the components of a material specification, analyse the sustainability-based material specifications, highlight the required specifications for greener products and materials, and introduce the Product Transparency Movement</p> <p><b>Greener Products and Materials:</b> Explain the rules for selection of greener materials, explain LEED Credits for materials and resources, highlight the importance of Durability and Performance of buildings, thermal and moisture protection, appropriate selection of house fixtures, indoor environmental quality and present issues of debate for discussion in class.</p> <p><b>Concrete, Masonry, Metals, Wood, Plastic, Composites:</b> Explain how to minimise their environmental impact and present practices and processes of recycling and reusing and also potential applications.</p>		
Recommended and/or required reading:			
Textbooks:	<b>"Green Building Materials: A Guide to Product Selection and Specification"</b> , Ross Spiegel and Dru		

	Meadows, Wiley Publishers, 2010.
References:	<p>“<b>Civil Engineering Materials</b>”, Jackson and Dhir, Palgrave Publishers, 1996.</p> <p>“<b>Construction Materials: Their Nature and Behaviour</b>”, edited by Illston and Domone, Spon Press; 1994.</p>
Planned learning activities and teaching methods:	<p>The course will be presented through theoretical lectures in class. The lectures will present to the student the course content and allow for questions. Part of the material will be 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.) that would otherwise be very difficult to do. The learning process will be enhanced with the requirement from the student to solve relevant examples. These include self-evaluation exercises which will be solved in class. These exercises will not be graded. Exercises will also be given as homework which will be part of their assessment. Besides from the notes taken by students in class, all of the course material will be made available through the class website and also through MOODLE. Finally the instructor will be available to students during office hours or by appointment in order to provide any necessary tutoring.</p>
Assessment methods and criteria:	<ul style="list-style-type: none"> <li>• Assignments                      10%</li> <li>• Tests:                                30%</li> <li>• Final Exam                        60%</li> </ul>
Language of instruction:	English
Work placement(s):	No