1.3 CE0130 – Structural Materials

(1) GENERAL

SCHOOL	ENGINEERING SCHOOL		
ACADEMIC UNIT	CIVIL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**CE0130**	**SEMESTER**	**1**
COURSE TITLE	**Structural Materials**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General Background Course
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (in English for ERASMUS students)
COURSE WEBSITE (URL)	https://eclass.uniwa.gr/courses/CIV350/ https://eclass.uniwa.gr/courses/CIV351/

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

The aim of the course is to introduce the students to the fundamental concepts of the most important Construction Materials, of their properties that influence their performance, of the methods to determine these properties based on European and international standards and of quality control criteria.

Upon successful completion of the course, students will be able to:

1. Identify the basic construction materials and their physical and mechanical properties.
2. Be familiar with the standard testing procedures for each construction material according to European and international standards.
3. Check the quality and suitability of construction materials.
4. Select the most appropriate material for the environmental and functional use in each case, according to standard criteria.

Specifically, students will be able to:

1. Have adequate comprehension skills of Construction Materials.
2. Evaluate the results of measuring procedures for Construction Materials.
3. Communicate the results of their work accurately and reliably.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?;.

Search for, analysis and synthesis of data and information, with the use of the necessary technology	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Production of new research ideas	*Others…*

Specifically, students will be able to perform:

- Search for, analysis and synthesis of data and information, using the necessary technologies.
- Decision making.
- Independent work.
- Work in an interdisciplinary environment.

(3) **SYLLABUS**

Theoretical Part:

Introduction: Historical and economic development of construction materials. Criteria for the selection and suitability of materials. Physical, chemical, mechanical and thermal properties of materials.

Standardization of construction materials: Standardization, controlling, testing. Material specifications. European and international standards.

Metallic construction materials: Criteria for the evaluation of materials. Classification. Structure. Metals - Alloys. Production, processing. Structural steel categories. Corrosion of metallic materials.

Rocks and natural stones: Geological distinction, mineralogical composition, controlling and testing of rocks. Categories of stones. Marble. Causes of destruction, means of protection and maintenance of natural stones.

Aggregates: Origin, production, mining, processing, classification. Characteristic properties. Sieve analysis. Regulations for standard curves. Suitability, controlling, testing of aggregates. Fineness modulus of aggregates. Special categories of aggregates.

Mortars: Categories. Production methods. Mechanisms of setting and hardening. Current regulations. Clays. Lime. Plaster. Resins. Mechanisms of setting and hardening. Controlling and testing. Suitability criteria.

Cement: manufacturing process, constituents, chemical composition, properties, and characteristics. Cement Regulations. Cement types and standard designation. Special cement categories. Mechanical, durability and chemical requirements. Hydration, fineness, consistency, compressive strength.

Concrete: Categories of concrete. Classification criteria. Exposure classes of concrete related to environmental actions. Raw materials for concrete. Cement and aggregates used. Concrete Technology Regulation. Concrete mix design calculations. Physicomechanical and chemical properties of concrete. Control methods. Workability of concrete and calculation methods.

Concrete durability: carbonation mechanism, penetration of chlorides, sulfate reactions, exposure to high temperatures, alkali-silica reaction. Corrosion, measures for protection and prevention of corrosion mechanisms, rehabilitation methods.

Laboratory Part:

Metallic materials: Thermal analysis, phase diagrams of alloys. Determination of indentation hardness according to Brinell, Vickers, and Rockwell methods. Metallography, optical microscopy, grain size estimation of metallic materials. Steels. Tension under static loading. Stress-Strain Diagram: Proportional and elastic limit, ield, ultimate and fracture point. Reduced conventional elongation at maximum load, hardening ratio, toughness.

Aggregates: methods for aggregates' sampling. Sieve analysis and grading composition of aggregates. Determination of bulk density, density and porosity of aggregates. Determination of moisture content and water absorption of coarse and fine aggregates. Determination of filler content. Sand purity control, equivalent test.

Concrete: Sampling, temperature, workability, apparent weight and air content of fresh compacted concrete. Compressive strength of concrete. Concrete mix design. Planning, design and laboratory testing of concrete mix design.
Cement: setting time, fineness, density, specific surface, compressive strength, volume stability.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Teaching using ICT, Communication and Electronic Submission.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non- directed study according to the principles of the ECTS*	<table><tr><th>*Activity*</th><th>*Semester workload*</th></tr><tr><td>Lectures</td><td>26</td></tr><tr><td>laboratory practice</td><td>26</td></tr><tr><td>Personal Study</td><td>58</td></tr><tr><td>Written assignments</td><td>20</td></tr><tr><td></td><td></td></tr><tr><td>Course total</td><td>**130**</td></tr></table>
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open- ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Language of evaluation: Greek English for Erasmus students Methods of evaluation: **Theoretical Part (50%)**: Written examination: 100% in the form of • multiple choice questionnaires, • short-answer questions, • problem solving. **Laboratory Part (50%)** • Problem solving written assignments (50%). • Written examination (50%).

(5) ATTACHED BIBLIOGRAPHY

Greek Bibliography:

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2. Triantafilou, A., (2017), Construction Materials, Patra: Gotsis Publications (in Greek).
3. Vatalis, A., (2009) Materials Science and Technology, Thessaloniki: Ziti Publications (in Greek).
4. Chryssoulakis, G., Pantelis, D., (2003), Science and Technology of Metallic Materials, Athens: Papasotiriou Publications (in Greek).
5. Koroneos, A., Poulakos, G., (2011), Technical Materials, Athens: Symmetria Publications (in Greek).
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7. Georgiadou, Z., (2021), Construction and Decorative Materials, Athens: Tziola Publications (in Greek).
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