Module Code	**CEU44A01 / CEP55E05**
Module Name	**CIVIL ENGINEERING MATERIALS**
ECTS Weighting[1]	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Prof Sara Pavia
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module, students should be able to: LO1. Understand low carbon cements and the use of reactive wastes and by products as Portland cement replacements. LO2. Recognise the potential of geopolymer cements, pozzolans and SCMs (supplementary cementitious materials) to lower the carbon impact of construction. LO3. Appreciate and understand sustainable materials and methods of construction. LO4. Critically interpret the results of engineering testing and scientific material analyses. LO5. Identify, analyse and solve problems relating to the durability and environmental impact of materials in constructions. Select the most appropriate materials for a particular use. LO6. Categorise non-structural cracking and corrosion phenomena in concrete and plan for their minimization or avoidance. LO7. Develop a regime for investigation of problems and deterioration and evaluate the quality and durability of building materials. LO8. Interpret and communicate effectively the results of research and laboratory experimentation. LO9. Practice high professional and ethical standards in relation to sustainable materials and the selection of quality, sustainable materials for building. **Graduate Attributes: levels of attainment**

	To act responsibly – LO 11, 8, 3,1. To think independently – LO 7, 6, 5,2, 1. To develop continuously – LO 10, 4, 1. To communicate effectively – LO 9, 3,1.
Module Content	The module provides the student with essential knowledge on the properties, use, deterioration and repair of some of the most important materials used for building including stone and ceramic brick, insulations Portland cement (PC) concrete, lime and PC mortar, metal and timber. • Limes and cements. Low carbon cements. Masonry mortars. Pozzolans. Repair mixes. • Concrete: Constituents, additives, admixtures. Durability, corrosion, cracking. Properties: strength, thermal and moisture movement. • Sustainable materials and construction: Building with earth, hemp-lime concretes, straw bale and other sustainable materials. Thermal and hygric properties. Production and application. • Insulation materials: Lime-based renders, cork and hemp materials, aerogels and CSB. Thermal and hygric properties. Production and application. • Stone: Origin, composition and durability. Testing. Properties and uses, quality control. Introduction to cleaning and restoration. • Brick: Clay brick and ceramics. Composition and manufacturing technologies. Shaping, drying and firing-vitrification. Decay/defects. • Timber: Hardwoods and softwoods. Structural timber. Laminates. Properties and decay.
Teaching and Learning Methods	Lectures, laboratories and site visits. The teaching strategy is a mixture of: • Lectures (27 hours), • laboratory practical's and site visits (12 hours), • research reports.

Assessment Details[2]
Please include the following:

- **Assessment component**
- **Assessment description**
- **Learning outcome(s) addressed**

Assessment Component	Assessment Description	LO Addressed	% of total	**Week due**
Examination	2 hour written exam	LO1- LO7	80%	April/May, as published by the exams office
Coursework	Four technical reports	LO8-LO11	20%	Week 10

Reassessment Requirements

2 hour 100% written examination

Contact Hours and Indicative Student Workload[2]

Contact hours: lectures 27 hours; laboratories and sites 12 hours.
Independent Study (preparation for course and review of materials): 60 hours
Independent Study (preparation for assessment, incl. completion of assessment): 30 hours

Recommended Reading List

- Download publications on cements, insulation, earth construction, lime-hemp concrete, lime-based materials from: **https://www.tcd.ie/research/profiles/?profile=pavias**
- *Stone, Brick and Mortar*. S. Pavía and J. Bolton. (2000) Wordwell.
- *Permeability and Porosity of Hardened Concrete.* R. West. (1997). In: Concrete-an essential update. Module I: Essential characteristics of concrete. IEI and the Irish Concrete Society.
- *Thermal and Shrinkage Movements.* R. West. (1997). In: Concrete-an essential update. Module 2: Essentials of early age concrete. IEI and the Irish Concrete Society.

Module Pre-requisite

Basic knowledge on Chemistry / Materials.

Module Website

https://www.tcd.ie/Engineering/undergraduate/baiyear4/modules/4A1.pdf

Academic Start Year

2025

Academic Year of Date

2025-26