

Module Code	CEU44A01 / CEP55E05
Module Name	Civil Engineering Materials
ECTS Weighting¹	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Sara Pavia
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	<p>On successful completion of this module, students should be able to:</p> <p>LO1. Understand and practice the use and application of low carbon cement made with waste to lower carbon emissions.</p> <p>LO2. Understand and practice the properties and application of geopolymers and supplementary cementitious materials to lower carbon emissions.</p> <p>LO3. Select quality building material, compatible with existing fabrics and responsible towards the environment.</p> <p>LO4. Identify and solve problems relating to the environmental impact and durability of building materials in construction.</p> <p>LO5. Select the most appropriate materials needed to solve a problem or perform a function.</p> <p>LO6. Critically interpret the results of engineering testing and scientific analysis of building materials.</p> <p>LO7. Categorise non-structural cracking and corrosion phenomena in concrete and plan for their minimization or avoidance.</p> <p>LO8. Develop a regime for investigation of materials problems and deterioration.</p> <p>LO9. Interpret and effectively communicate the results of research and laboratory experimentation.</p> <p>LO10. Practice high professional standards in relation to sustainable materials.</p> <p>LO11. Practice high ethical standards concerning the selection of low-carbon, sustainable materials for construction.</p>

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.

- Geopolymers and supplementary cementitious materials to lower the carbon emissions of construction.
- Low carbon cements made with waste. Reactivity of silicate waste. Alkali activation.
- Forensic engineering: analytical and survey techniques to diagnose problems and contamination.
- Masonry mortars. Pozzolans. Repair mixes.
- Durability, corrosion, cracking. Properties: strength, thermal and moisture movement.
- Insulation materials: Lime-based renders, cork and hemp materials, aerogels and CSB. Thermal and hygric properties. Production and application.
- Masonry. Historic masonry: properties and repair. Building limes. Testing.
- Stone, clay brick/block. Composition and manufacturing technologies. Structural properties. Durability.
- Timber: Cross Laminated Timber. Hardwoods and softwoods. Structural timber. Properties and durability.

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 Details² Please include the following: <ul style="list-style-type: none"> • 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 Workload²

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 etc. from: <https://www.tcd.ie/research/profiles/?profile=pavias>
- *Stone, Brick and Mortar*. S. Pavia and J. Bolton. (2000) Wordwell.
- *Permeability and Porosity of Hardened Concrete*. R. West. (1997). In: Concrete-an essential update. Module 1: 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

2024

Academic Year of Date

2024-25