

Module Template for New and Revised Modules

Module Code	CEU44A01
Module Name	Civil Engineering Materials
ECTS Weighting¹	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Sara Pavia
<u>Module Learning Outcomes</u> with reference to the <u>Graduate Attributes</u> and how they are developed in discipline	<p>On successful completion of this module, students should be able to:</p> <p>LO1. Select quality building material, compatible with existing fabrics and responsible towards the environment.</p> <p>LO2. Identify, analyse and solve problems relating to the durability and environmental impact of building materials in constructions.</p> <p>LO3. Select the most appropriate materials needed in order to solve a problem or to be employed for a particular use.</p> <p>LO4. Critically interpret the results of engineering testing and scientific analysis of building materials.</p> <p>LO5. Differentiate between choices of concrete mix constituents and site process.</p> <p>LO6. Categorise non-structural cracking and corrosion phenomena in concrete and plan for their minimization or avoidance.</p> <p>LO7. Develop a regime for investigation of materials problems and deterioration.</p> <p>LO8. Effectively determine the relevant experiments and analysis needed to evaluate the quality and durability of building materials.</p> <p>LO9. Interpret and communicate effectively the results of research and laboratory experimentation.</p> <p>LO10. Practice high professional standards in relation to sustainable materials and the repair and conservation of traditional and historic fabrics.</p> <p>LO11. Practice high ethical standards concerning the selection of quality and sustainable materials for building.</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.

- Mortar: Types and function. Aggregate and binders. Properties/uses of lime and PC mortars. Pozzolans. Effect of mortar on the decay of fabrics. Repair mixes.
- Concrete: Constituents, additives, admixtures. Durability, corrosion, cracking. Properties: strength, thermal and moisture movement. New materials. Concrete investigation.
- 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.
- Steel: Manufacture. Corrosion and fire protection.

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:

- 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%	In April, as published by the exams office
Coursework	Four technical reports	LO8-LO11	20%	

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 insulation, earth construction, lime-hemp concrete, lime-based materials 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 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.
- *Steel designers' manual (Chaps 34 & 35)*. The Steel Construction Institute. Blackwell Scientific.

Module Pre-requisite	1 st / 2 nd year modules in Chemistry and Materials.
Module Co-requisite	None
Module Website	https://www.tcd.ie/Engineering/undergraduate/baiyear4/modules/4A1.pdf
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	No
Module Approval Date	
Approved by	
Academic Start Year	September 2022
Academic Year of Date	2022-23