

# ES2C3-15 Civil Engineering Materials and Structural Analysis

**22/23**

**Department**

School of Engineering

**Level**

Undergraduate Level 2

**Module leader**

Reyes Garcia

**Credit value**

15

**Module duration**

10 weeks

**Assessment**

40% coursework, 60% exam

**Study location**

University of Warwick main campus, Coventry

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## Description

### Introductory description

ES2C3-15 Civil Engineering Materials and Structural Analysis

[Module web page](#)

### Module aims

The aims of the module are to introduce the rationale behind appraisal and design of structures; the main activity of many professional civil engineers. The module will lay the foundations for more advanced and specific structure design modules, since it will review and more deeply explain fundamental structural analysis concepts such as stress and strain, statical determinacy and bending moment/shear forces. A range of materials (concrete, timber, masonry and fibre reinforced polymers) will be investigated in terms of structural behaviour, analysis and design. Especially for concrete the module will provide knowledge and understanding on its constituent materials, their properties and those of fresh and hardened concrete. Variables that affect these properties in the short and long term will be identified.

### Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

#### Structures:

- o Stress and Strain: combination and failure criteria
- o Elastic theory of bending and torsion
- o Linear elastic analysis of statically determinate and indeterminate structures
- o Qualitative structural analysis

#### Materials:

- o Introduction
- o Portland Cement: Manufacture, Composition and Hydration
- o Other Cements: Classification, Modified PC, CRMs, non-Portland cements
- o Aggregates and admixtures
- o Fresh Concrete and Curing
- o Hardened concrete: Strength, testing and variation
- o Durability of Concrete
- o Sustainability and Concrete
- o Introduction to Timber, Masonry and Fibre Reinforced Polymers

### **Learning outcomes**

By the end of the module, students should be able to:

- Show knowledge and understanding of how concrete samples can be cast, moulded and cured to assess the property and quality of concrete.
- Demonstrate detailed understanding of stress and strain states in structural elements
- Perform qualitative and quantitative structural analysis.
- Analyse the effects of material and process variables on the mechanical properties of concrete.
- Appreciate the sustainability issues and latest UK regulatory framework surrounding the manufacture and use of cement and concrete.
- Evaluate the structural behaviour of a range of civil engineering materials such as concrete, timber, masonry and fibre reinforced polymers.

### **Indicative reading list**

Megson, T. H. G., Structural and Stress Analysis, Elsevier, 3rd Ed., Oxford, 2014.

Millais, M., Building Structures: from Concepts to Design, 2nd Ed., Routledge, 2005.

Domone, P. and Illston, J (Eds.), Construction Materials: Their Nature and Behaviour, 4th Ed., T & F Books, London, New York, 2010.

Neville, A. M., Concrete Technology, 2nd Ed., Prentice Hall, 2010.

Internet based sites (such as MPA and UK government) for up-to-date sources on sustainable cements and concretes.

### **Subject specific skills**

Ability to apply basic principles and different methods to carry out the qualitative and quantitative analysis of structures.

Understand the need of reading technical literature (textbooks, articles) to solve structural problems.

Ability to apply practical skills in the design of concrete mixes, as well as the H&S risks associated with it.

Knowledge and understanding of risk issues, including health & safety, and environmental aspects of materials in civil engineering.

### **Transferable skills**

Apply mathematical and problem-solving skills to analyse civil engineering structures.

Plan self-learning and work-load prioritisation.

Overcome difficulties by employing skills developed in Year 1.

Develop team-working skills in concrete mixing/testing laboratories.

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## **Study**

### **Study time**

<b>Type</b>	<b>Required</b>
Lectures	10 sessions of 3 hours (20%)
Practical classes	3 sessions of 3 hours (6%)
Other activity	7 hours (5%)
Private study	104 hours (69%)
Total	150 hours

### **Private study description**

104 hours of guided independent learning

### **Other activity description**

- 5 x 1 hours Examples Classes
- 2 hours Revision Lectures

### **Costs**

No further costs have been identified for this module.

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## **Assessment**

You must pass all assessment components to pass the module.

## Assessment group D2

	Weighting	Study time
Written assignment	40%	
Open-ended written assignment (max length 10 pages)		
Online Examination	60%	
QMP		
~Platforms - AEP,QMP		

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- Online examination: No Answerbook required
- Students may use a calculator
- Engineering Data Book 8th Edition
- Graph paper

## Feedback on assessment

Written examination: cohort level feedback.

Solutions to problems and questions for exam preparation.

[Past exam papers for ES2C3](#)

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## Availability

### Post-requisite modules

If you pass this module, you can take:

- ES3D1-15 Concrete Structures
- ES4F4-15 Advanced Structural Engineering
- ES4E3-15 Structural Dynamics and Vibration
- ES97P-15 Earthquake Resilient Structures
- ES3E1-30 Design Project with Construction Management (Civil Engineering, BEng)
- ES3E2-15 Civil Engineering Design II
- ES3D2-15 Steel Structures
- ES3B6-30 Geotechnical Engineering

## Courses

This module is Core for:

- Year 2 of UESA-H216 BEng Civil Engineering
- Year 2 of UESA-H217 MEng Civil Engineering

This module is Option list A for:

- Year 2 of UESA-H113 BEng Engineering
- UESA-H112 BSc Engineering
  - Year 2 of H112 Engineering
  - Year 2 of H112 Engineering
- Year 2 of UESA-HN11 BSc Engineering and Business Studies
- Year 2 of UESA-H114 MEng Engineering