

# ES3D1-15 Concrete Structures

**22/23**

**Department**

School of Engineering

**Level**

Undergraduate Level 3

**Module leader**

Georgia Kremmyda

**Credit value**

15

**Module duration**

10 weeks

**Assessment**

100% exam

**Study location**

University of Warwick main campus, Coventry

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## Description

### Introductory description

ES3D1-15 Concrete Structures

[Module web page](#)

### Module aims

The design of concrete structures is a main stream activity of professional civil engineers. The module aims at developing ability to conduct structural design of reinforced concrete elements (slabs including two way slabs and flat plates, beams and columns).

### 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.

Design process; structural form and action; choice of material; uncertainties in design: partial safety factors. Limit States.

Design of reinforced concrete beams to ULS: design assumptions; resistance to bending; stress and strain blocks; design formulae for singly and doubly reinforced rectangular sections;

examples.

Design of T- and L-beam sections in bending; examples

Design for shear; truss analogy; examples

Serviceability limit state (SLS): elastic theory; deflections, cracking; bond and anchorage; calculation and control of crack widths; examples

Design of reinforced concrete columns; axially loaded short columns; eccentric load; principles of column interaction diagrams; slender columns; biaxial bending; examples.

Reinforced concrete slabs; one-way and two-way spanning elements, flat slabs. Shear in slabs: punching shear; examples.

## **Learning outcomes**

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

- Communicate the relationship between design, durability and cost, ease of construction.
- Distinguish the physical behaviour of under and over reinforced concrete members.
- Consolidate the fundamental principles of structural design for concrete structures, including principles of Limit State Design, margins of uncertainty associated with loading, material
- Design and check for serviceability (crack and deflection) conditions and for ultimate limit state conditions in accordance with relevant reinforced concrete design standards (Eurocodes).
- Critically examine the results of structural design of concrete sections.

## **Indicative reading list**

Millais, M., 'Building Structures: from Concepts to Design,' 2nd Ed., Taylor & Francis, 2005.

Arya, C., Design of Structural elements, Spon Press, 2009.

Mosley, W.H., Hulse, R., Bungey, J.H. Reinforced Concrete Design: to Eurocode 2, 7th ed. Palgrave Macmillan, 2012.

## **Subject specific skills**

1. Ability to conceive, make and realise a component
2. Ability to develop economically viable and ethically sound sustainable solutions
3. Ability to be pragmatic, taking a systematic approach and the logical and practical steps necessary for, often complex, concepts to become reality
4. Ability to seek to achieve sustainable solutions to problems and have strategies for being creative and innovative
5. Ability to be risk, cost and value-conscious, and aware of their ethical, social, cultural, environmental, health and safety, and wider professional engineering responsibilities
6. Ability to apply relevant practical and laboratory skills

## **Transferable skills**

1. Apply problem solving skills, information retrieval, and the effective use of general IT facilities
2. Awareness of the nature of business and enterprise in the creation of economic and social

value

3. Overcome difficulties by employing skills, knowledge and understanding in a flexible manner
  4. Ability to formulate and operate within appropriate codes of conduct, when faced with an ethical issue
  5. Appreciation of the global dimensions of engineering, commerce and communication
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## Study

### Study time

| Type              | Required                    |
|-------------------|-----------------------------|
| Lectures          | 34 sessions of 1 hour (23%) |
| Practical classes | 3 sessions of 1 hour (2%)   |
| Private study     | 113 hours (75%)             |
| Total             | 150 hours                   |

### Private study description

113 hours guided independent learning

### 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.

Students can register for this module without taking any assessment.

### Assessment group B2

|                      | Weighting | Study time | Eligible for self-certification |
|----------------------|-----------|------------|---------------------------------|
| Assessment component |           |            |                                 |
| Online Examination   | 100%      |            | No                              |
| 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

Reassessment component is the same

## **Feedback on assessment**

Feedback in examples class.

Model solutions to recent past papers.

Cohort level feedback on examinations.

[Past exam papers for ES3D1](#)

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## **Availability**

### **Pre-requisites**

To take this module, you must have passed:

- All of
  - [ES2C2-15 Civil Engineering Design 1](#)
  - [ES2C3-15 Civil Engineering Materials and Structural Analysis](#)

### **Post-requisite modules**

If you pass this module, you can take:

- ES4F4-15 Advanced Structural Engineering
- ES97P-15 Earthquake Resilient Structures
- ES4E3-15 Vibration of Civil and Mechanical Engineering Structures

## **Courses**

This module is Core for:

- Year 3 of UESA-H216 BEng Civil Engineering
- Year 4 of UESA-H215 BEng Civil Engineering with Intercalated Year
- Year 3 of UESA-H217 MEng Civil Engineering
- Year 4 of UESA-H218 MEng Civil Engineering with Intercalated Year

This module is Core optional for:

- Year 3 of UESA-H218 MEng Civil Engineering with Intercolated Year
- Year 3 of UESA-H115 MEng Engineering with Intercolated Year

This module is Optional for:

- Year 3 of UESA-H113 BEng Engineering
- Year 3 of UESA-H114 MEng Engineering
- Year 4 of UESA-H115 MEng Engineering with Intercolated Year
- UESA-H11L Undergraduate Engineering (with Intercolated Year)
  - Year 3 of H11L Engineering (with Intercolated Year)
  - Year 4 of H11L Engineering (with Intercolated Year)

This module is Option list A for:

- Year 4 of UESA-H111 BEng Engineering with Intercolated Year
- Year 3 of UESA-H112 BSc Engineering