# Module Descriptor Form

## Civil and Environmental Engineering

**CL313 - Structural Engineering 1**

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|---|---|---|---|---|---|---|---|
| **Module Code** | CL313 | **Module Title** | Structural Engineering 1 | | | | |
| **Module Registrar** | Valentine, Mrs Viola | | | | | | |
| **Other Staff Involved** | | | | | | | |
| **Credit Weighting** | 20 | **Semester** | 1/2 | **Elective** | No | **Academic Level** | 3 |
| **Pre-requisites** | CL207 | | | | | | |
| **Required for** | CL418 | | | | | | |

**Module Format and Delivery (hours):**

| Lectures | Tutorials | Assignments | Labs | Private Study | Total |
|---|---|---|---|---|---|
| 22 | 18 | 26 | 6 | 128 | 200 |

**Educational Aim**

*This module aims to:*

provide an introduction to reinforced concrete and structural steelwork design of simple elements. It also aims to introduce and instil understanding of the main analysis methods for calculating deflections and statically indeterminate structures.

**Syllabus**

*This module will teach the following:*

Semester 1 (exchange CL335)

- Introduction to reinforced concrete design
- Principles of reinforced concrete design
- Technical design of simple reinforced concrete elements
- Introduction to steel structures
- Principles of steel structures design
- Technical design of simple steel elements

Semester 2 (exchange CL336)

- Introduction to energy principles and working assumptions;
- Principles of virtual forces for evaluating deflections;
- Force (a.k.a. flexibility) method for statically indeterminate structures
- Stiffness (a.k.a. displacement) method for statically indeterminate structures
- Computer-oriented stiffness method for structural analysis

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**Learning Outcomes**

*On Completion of the module, the student is expected to be able to:*

| | |
|---|---|
| LO: 1 | Understand the principles of reinforced concrete design. |
| LO: 2 | Perform simple element design calculations for reinforced concrete members. |
| LO: 3 | Understand the principles of structural steelwork design. |
| LO: 4 | Perform simple element design calculations for structural steel members. |
| LO: 5 | Solve statically-indeterminate structures using force-based and stiffness-based methods. |
| LO: 6 | Familiarise with computer-based structural analysis and related software. |
| LO: 7 | Calculate structural deflections with energy-based methods. |

*(UK SPEC suggests no more than 4 learning outcomes per module. Statements must be broad and be syllabus free and link in with the intended learning outcomes on the programme specifications.)*

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**Assessment of Learning Outcomes - Criteria**

Learning Outcome: **1**

| | **Criteria** |
|---|---|
| 1 | Knowledge of the idealised stress/strain behaviour of concrete and reinforcement steel bars. |
| 2 | Understanding of the derivation from first principles of formulae used to calculate the areas of tension steel reinforcement in flexural elements. |
| 3 | Use lab testing to understand the behaviour of reinforced concrete beams. |

Learning Outcome: **2**

| | **Criteria** |
|---|---|
| 1 | Ability to select a suitable concrete grade and nominal cover for reinforced concrete elements. |
| 2 | Ability to carry out the technical design of reinforced concrete slabs (one-way spanning) and continuous beams in accordance with Eurocode 2. |

Learning Outcome: **3**

| | **Criteria** |
|---|---|
| 1 | Ability to use the concepts of engineering mechanics, stress, strain and strength to determine the response of members under practical loading. |
| 2 | Ability to use the principles of steel structures to check the design adequacy of members under practical loading. |
| 3 | Ability to determine the main design parameters affecting the structural response of members under practical loading. |
| 4 | Use lab testing to understand the behaviour of steel beams. |

Learning Outcome: **4**

| | **Criteria** |
|---|---|
| 1 | Ability to apply current Eurocode procedures to the design of tension, bending and compression steel members. |
| 2 | Ability to use current Eurocode procedures to select the appropriate size of steel members. |
| 3 | Ability to assess the serviceability of designed elements under serviceability limit state. |

Learning Outcome: **5**

| | **Criteria** |
|---|---|
| 1 | Ability to apply the Euler-Bernoulli beam theory to analyse simple statically-indeterminate beams. |
| 2 | Ability to apply the Force-based method to analyse statically-indeterminate beams and frames. |
| 3 | Ability to apply the Stiffness-based method to analyse statically-indeterminate beams and frames. |
| 4 | Ability to select the most efficient method for solving different structural analysis problems. |

Learning Outcome: **6**

| | **Criteria** |
|---|---|
| 1 | Knowledge of the basic concepts of matrix-based structural analysis underlying computer software. |
| 2 | Ability to use structural analysis software for solving simple problems. |

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Learning Outcome: **7**

| | Criteria |
|---|---|
| 1 | Ability to apply the Euler-Bernoulli beam theory to evaluate deflections of beams. |
| 2 | Knowledge of the basic principles of energy, virtual work, virtual forces and virtual displacements. |
| 3 | Ability to apply the principle of virtual forces to determine deflections at specific points of a structure. |

### Assessment Method(s) Including Percentage Breakdown and Duration of Exams

To Pass the module, students need to gain a summative mark of: 40%

| Description | Semester | Start Week | Duration | Weight | Submission Week | Linked Criteria |
|---|---|---|---|---|---|---|
| Assignment S32 RC Design | 1 | 2 | | 10% | 5 | LO 1: C1, C2<br>LO 2: C1, C2 |
| Beam Lab S31 | 1 | 5 | | 10% | 10 | LO 1: C1, C2, C3<br>LO 3: C4 |
| Semester 1 End-of-term exam. Closed Book | 1 | | 2.00 | 30% | E | LO 1: C1, C2<br>LO 2: C1, C2<br>LO 3: C1, C2, C3<br>LO 4: C1, C2, C3 |
| Quiz 1 - Deflection and force method | 2 | 5 | | 5% | 6 | LO 5: C1, C2, C3, C4<br>LO 7: C1, C2, C3 |
| Quiz 2 - Stiffness method | 2 | 8 | | 5% | 9 | LO 5: C1, C2, C3, C4 |
| Computer-based RSA Lab | 2 | 9 | | 10% | 11 | LO 6: C1, C2 |
| Semester 2 End of term exam. Open Book: Any books, lecture material and student own notes etc. | 2 | | 2.00 | 30% | E | LO 5: C1, C2, C3, C4<br>LO 7: C1, C2, C3 |

### Principles of Assessment Feedback

Principles of Assessment and Feedback
(within Assessment and Feedback Policy at:
https://www.strath.ac.uk/staff/policies/academic/http://www.strath.ac.uk/learnteach/informationforstaff/staff/assessfeedback/12principles/ )

These are incorporated in this module as follows:

1. Marking criteria are outlined clearly in the assignment handout and multiple opportunities for questions are available, either in class, via email or forum in Myplace class page. Each marking sheet is taken directly from this handout.

2. Group assignments encourage interaction between peer groups and with the instructor.

3. Tutorial questions are provided to support student self-assessment and reflection.

4. Departmental policy is to carry out mid-term class assessments and provide feedback to students.

### Additional Information

Students need to gain a summative mark of 40% to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of exam. Students who are absent from both exams will be returned as Absent.

### Resit Procedure

Students who fail the module at the first attempt will need to resit an exam for each semester that they failed. If a student has failed both semesters (S1 & S2), then they will need to resit two exams, one for S1 material and another exam for S2 material, each accounting for 50%. Students must achieve a mark of 40% overall in the resit to pass the module. No marks from any previous attempts will be transferred to the resit attempt.

### Recommended Reading

***Purchase recommended **Highly recommended reading *For reference


- BS EN 1990, Eurocode 0: Basis of Structural Design.
- BS EN 1991, Eurocode 1: Actions on Structures – Part 1-1.
- BS EN 1992, Eurocode 2: Design of Concrete Structures – Part 1-1 and 1-2.
- BS EN 1993, Eurocode 3: Design of Steel Structures – Part 1-1.
- Course notes provided on Myplace in the folder for CL313,335,336
- ***Mosley, B., Bungey, J. and Hulse, R. (2012) Reinforced Concrete Design to Eurocode 2. 7th edn. London: Palgrave.
- **SCI, Davison, B. and Owens, G. W. (2015) Steel Designers' Manual. 7th edn. Chichester: Wiley-Blackwell.
- *Arya, C. (2009) Design of Structural Elements. 3rd edn. London and New York: Routledge.
- **Megson, T. H. G. (2005) Structural and Stress Analysis. 2nd edn. Oxford: Butterworth-Heinemann.
- ***Hibbeler, R. C. (2017) Structural Analysis. 9th edn. Pearson.
- * Leet, K. M. et al (2017) Fundamentals of Structural Analysis. 5th edn. McGraw Hill Education.
- *Nielson, B. G. and McCormac, J. C. (2017) Structural Analysis: Understanding Behavior. Wiley.
- *Weaver, W. and Gere, J. M. (1990) Matrix Analysis of Framed Structures. 3rd edn. Springer.

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**Module Timetable**

| Week | Semester 1 | Semester 2 |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | Submission 10% | |
| 6 | | Submission 5% |
| 7 | | |
| 8 | | |
| 9 | | Submission 5% |
| 10 | Lab 10% | |
| 11 | | Submission 10% |
| E | Examination 30% | Examination 30% |

**Date of Last Modification**

16-09-2025