MODULE DESCRIPTION FORM – 2022/2023

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

CL313, CL335, CL336 Structural Engineering 1

Module Registrar: Viola Valentine	**Taught To (Course): BEng/MEng Civil/Civil and Environmental Engineering**		
Other Lecturers Involved: Marco De Angelis, Enrico Tubaldi	**Credit Weighting: 20**	**Semester: 1 and 2**	
Assumed Prerequisites: **All compulsory undergraduate civil engineering classes up to the end of 2nd year or equivalent**	**Compulsory/ ~~optional/ elective~~ class**	**Academic Level: 3**	**Suitable for Exchange: Y/~~N~~**

Module Format and Delivery (HOURS i.e. 1 credit = 10hrs of study):

Lecture	Tutorial	Laboratory	Groupwork	External	Online	Project	Assignments	Private Study	**Total**
15 (S1) 12 (S2)	10 (S1) 8 (S2)	4 (S1) 2 (S2)	5 (S1)				6 (S1) 10 (S2)	60 (S1) 68 (S2)	100 (S1) 100 (S2)

Educational Aim

This module aims to provide an introduction to reinforced concrete and structural steelwork design. It also aims to introduce and develop understanding of the main analysis methods for statically indeterminate structures.

Learning Outcomes

On completion of the module the student is expected to be able to:

Semester 1 (exchange CL335)

LO1: Understand the principles of reinforced concrete design.

LO2: Perform simple element design calculations for reinforced members.

LO3: Understand the principles of structural steelwork design.

LO4: Perform simple element design calculations for structural steel members.

Semester 2 (exchange CL336)

LO5: Solve statically-indeterminate structures using force-based and stiffness-based methods.

LO6: Understand the principles of computer-based structural analysis.

LO7: Evaluate structural deflections.

Syllabus

The module will include 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)

- Euler-Bernoulli beam theory;
- Principle of virtual work;
- Force (a.k.a. flexibility) method for structural analysis
- Stiffness (a.k.a. slope-deflection) method for structural analysis
- Computer-Oriented Stiffness Method for structural analysis

Assessment of Learning Outcomes

Criteria

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

LO1: Understand the principles of reinforced concrete design.

- C1 Knowledge of the idealised stress/strain behaviour of concrete and reinforcement steel bars.
- C2 Understanding of the derivation from first principles of formulae used to calculate the areas of tension steel reinforcement in flexural elements.
- C3 Use lab testing to understand the behaviour of reinforced concrete beams.

LO2: Perform simple element design calculations for reinforced members.

- C1 Ability to select a suitable concrete grade and nominal cover for reinforced concrete elements.
- C2 Ability to carry out the technical design of reinforced concrete beams and slabs in accordance with Eurocode 2.

LO3: Understand the principles of structural steelwork design.

- C1 Ability to use the concepts of engineering mechanics, stress, strain and strength to determine the response of members under practical loading.
- C2 Understanding of the theory of Euler Buckling.
- C3 Ability to use the principles of steel structures to check the design adequacy of members under practical loading.
- C4 Ability to determine the main design parameters affecting the structural response of members under practical loading.

LO4: Perform simple element design calculations for structural steel members.

- C1 Ability to apply current Eurocode procedures to the design of bending, tension and compression steel members.
- C2 Ability to apply current Eurocode procedures to the design of steel connection members.
- C3 Ability to use current Eurocode procedures to select the appropriate size of steel members.
- C4 Ability to assess the serviceability of designed elements under serviceability limit state.

LO5: Solve statically-indeterminate structures using force-based and stiffness-based methods.

- C1 Ability to apply the Euler-Bernoulli beam theory to analyse simple statically-indeterminate beams.
- C2 Ability to apply the Force-based method to analyse statically-indeterminate beams and frames.
- C3 Ability to apply the Stiffness-based method to analyse statically-indeterminate beams and frames.
- C4 Ability to select the most efficient method for solving different structural analysis problems

LO6: Understand the principles of computer-based structural analysis.

- C1 Knowledge of the basic concepts of matrix-based structural analysis underlying computer software
- C2 Ability to use structural analysis software for solving simple problems.

LO7: Evaluate structural deflections.

- C1 Ability to apply the Euler-Bernoulli beam theory to evaluate deflections of beams.
- C2 Knowledge of the basic principles of energy, virtual work, virtual forces and virtual displacements.
- C3 Ability to apply the principle of virtual forces to determine deflections at specific points of a structure.

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

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 or through electronic correspondence. 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.

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

	Examinations				**Courseworks**		**Projects**	
	Number	Month(s)	Duration	***Weighting***	Number	***Weighting***	Number	***Weighting***
	1 (S1) 1 (S2)	December April/May	2hrs 2hrs	33% 33%	2 3	17% 7%	1	10%
L/Outcomes	1, 2, 3, 4, 5 and 7				1, 2, 5 and 7		6	

Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.

Coursework / Submissions deadlines (*academic weeks*):
Semester 1: week 6 and 10
Semester 2: week 5, 8 and 11

Resit Assessment Procedures:
2hr examination for semester 1 exam and/or 2hr examination for semester 2 exam, resit in August diet.

PLEASE NOTE:
Students must 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 resit exam(s). The resit mark will be 100% of the resit exam(s). No marks from any previous attempts will be transferred to a new 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.

Additional Student Feedback

(Please specify details of when additional feedback will be provided)

Date	Time	Room No

Session:

Approved:

Course Director Signature:
Date of Last Modifications: August 2022

(Updated May 2018)

MODULE TIMETABLE

Module Code:	**CL313, CL335, CL336**	**Module Title:**	**Structural Engineering 1**

Brief Description of Assessment:	
Semester 1: • Assignment S32 (RC Design) - 10% - Group, LO 1&2; • RC Beam Lab S31 - 7% - Group – LO 1&2; • End of term exam – 33%- Individual – LO 1,2,3 & 4	Semester 2: • Quiz 1 (Deflection evaluation and Force method)– 3% - Individual – LO 5 & 7, • Quiz 2 (Stiffness method) – 4% - Individual – LO 5, • Structural Analysis Lab – 10% - individual – LO 6; • End of term exam – 33% - Individual – LO 5 & 7

Assessment Timing:-

Indicate on the table below the start/submission dates for each assignment/project and the timing of each exam/assessment using the dropdowns provided. Dropdowns can be left blank. Add extra notes below the dropdowns.

Please note: Timings can and will change, this should only be used as a guide.

Semester One	W&D Wk	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
	Choose an item. Choose an item.	Choose an item. Choose an item.	Course work Set Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Lab	Course work Submit Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Lab Report Submission	Choose an item. Choose an item.	Exam

Semester Two	C&D Wk	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Quiz One Set	Quiz One Submit	Choose an item. Choose an item.	Quiz Two Set	Quiz Two Submit	Choose an item. Lab	Choose an item. Lab Report Submission	Exam