MODULE DESCRIPTOR 2021/2022

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

CL313 STRUCTURAL ENGINEERING 1

Module Registrar: **Viola Valentine**	**Taught To (Course): BEng/MEng Civil/Civil and Environmental Engineering**		
Other Lecturers Involved: **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+10	10+8	4+2	6+0				6+10	59+70	100 +100 =200

Educational Aim

This module aims to provide an introduction to reinforced concrete and structural steelwork design, as well as 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:

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.

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 teach the following:

- 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
- 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 theory of matrix-based structural analysis and understanding of why it is amenable to computer programming.
- C2 Ability to apply matrix-based structural analysis 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 principle of virtual work, virtual forces and virtual displacements.
- C3 Ability to apply the principle of virtual work 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/)

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+1	Dec, Apr/May	3hrs 3hrs	66%	2+2	17%+7%	1	10%
L/Outcomes	1, 2, 3, 4, 5 and 7				1, 2, 5 and 7		6	

Indicate which learning outcomes (LO1, LO2 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 and 8

Resit Assessment Procedures:
3hr examination for semester 1 exam and 3hr 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 with resit assessment procedures as above. This re-examination will consist entirely of 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 2021

ASSESSMENT TIMETABLE

Module Code	CL313	Module Title	Structural Engineering 1

Indicate in the tables below the Hand-Out (H), Submission (S) and Feedback (F) week number for each assignment (lab report/coursework/project etc) and the timing of each Exam (E), Class Test (CT) or Quiz (Q)

Semester 1

Assessment type & title	LOs	Weight (%)	Individual or Group	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
Assignment S32 – RC Design	1 and 2	10%	Group		H				S			F			
RC beam lab S31	1 and 2	7%	Group					H					S		F
Exam	1, 2, 3 and 4	33%	Individual												E (3)

Semester 2

Assessment type & title	LOs	Weight (%)	Individual or Group	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
Quiz 1- Deflection evaluation and Force method	5,7	3%	Individual					Q	F						
Quiz 2- Stiffness method	5	4%	Individual								Q	F			
Computer-based stiffness method Lab	6	10%	Individual									H		S	F
Exam	5,7	33%	Individual												E (3)

Appendix

Mapping Module Learning Outcomes to AHEP

Learning outcomes	Engineering Council AHEP competencies
LO1: Understand the principles of reinforced concrete design.	Engineering Analysis, Design and Engineering Practice
LO2: Perform simple element design calculations for reinforced members.	Engineering Analysis, Design and Engineering Practice
LO3: Understand the principles of structural steelwork design.	Engineering Analysis, Design and Engineering Practice
LO4: Perform simple element design calculations for structural steel members.	Engineering Analysis, Design and Engineering Practice
LO5: Solve statically-indeterminate structures using force-based and stiffness-based methods.	Engineering Analysis, Design and Engineering Practice
LO6: Understand the principles of computer-based structural analysis.	Engineering Analysis, Design and Engineering Practice
LO7: Evaluate structural deflections.	Engineering Analysis, Design and Engineering Practice

Programme Threads

	Assessment Title		
Thread	**Primary**	**Secondary**	**Contributory**
Design	**X**		
Health, Safety & Risk Assessment			**X**
Sustainability			**X**
Professionalism, Ethics, Diversity and Inclusion			**X**
Application of Maths to solve engineering problems		**X**	
Industrial Engagement & Site Visits			**X**
Digital Technologies		**X**	