

MODULE DESCRIPTION FORM



DEPARTMENT OF CIVL AND ENVIRONMENTAL ENGINEERING

CL419 GEOTECHNICAL ENGINEERING 2

Module Registrar: Stewart Beattie	Taught To (Course): Meng/BEng Civil Engineering/ Civil and Environmental Engineering		
Other Lecturers Involved: Alessia Amabile	Credit Weighting: 20	Semester: 1 & 2	
Assumed Prerequisites: CL314 Geotechnical Engineering 1	Compulsory class	Academic Level: 4	Suitable for Exchange: Y

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

Lecture	Tutorial	Laboratory	Groupwork	External	Online	Project	Assignments	Private Study	Total
32	16					40	40	72	200

Educational Aim

This module aims to introduce students to the principles of the design of geotechnical structures to Eurocode 7, and then apply this knowledge together with the fundamental analytical methods, to the design of slopes, retaining walls and foundations. Design will be taught in the context of foundations, ground investigation and the development of ground models, in order to demonstrate how design is carried out in practice.

Learning Outcomes

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

LO1 Understand and apply the principles of geotechnical design based on Eurocode 7, considering limit states (ultimate & serviceability) and design geotechnical structures to Eurocode 7, including interpretation of ground investigation information.

LO2 Understand the principles governing the stability of slopes and in various ground conditions, design engineering slopes and understand how to mitigate natural slope failures.

LO3 Understand the principles governing the stability retaining walls in various ground conditions, and design gravity and embedded walls including anchor systems.

LO4 Calculate the design bearing capacities of shallow foundations and pile foundations, taking account of foundation shape, load inclination, load eccentricity and ground conditions.

Syllabus

The module will teach the following:

Semester 1

Topic 1. Introduction to geotechnical design

Introduction to geotechnical structures; slopes and embankments, shallow foundations, pile foundations, retaining walls. Serviceability limit state and ultimate limit state in Geotechnics. Design according to EC7 and application of partial factors. Process of geotechnical design. Analytical methods; limit equilibrium, plasticity theories, finite element, observational method.

Topic 2. Shallow Foundations

Bearing capacity of shallow foundations. Basis of bearing capacity theory (introduction to upper bound solutions). General shear failure, local shear failure and punching shear failure. Bearing capacity calculations for strip footings, bearing capacity factors for shape, depth and inclination. Ground movements related to foundations. Calculation of design resistance according to EC7. Geotechnical investigations and reporting.

Topic 3. Deep Foundations

Bearing capacity calculations for pile foundations. Pile load testing. Settlement of piled foundations. Negative skin friction and piles in tension. Calculation of design resistance according to EC7.

Semester 2

Topic 4. Stability of slopes

Different types of slopes and slope failures (rotational, translational and compound slips). Stability analysis of infinite slopes, with and without seepage. Limit equilibrium methods and their limitations. Method of slices for undrained and drained analysis (Fellenius, Bishop). Surcharges and line loads, tension cracks, submerged slopes. Use of stability charts (Taylor and Bishop).

Topic 5. Stability of retaining walls

Earth pressure distributions for horizontal and sloping backfill using Coulomb and Rankine theories. Design of gravity retaining walls to EC7.

Types of embedded walls. Design of cantilever walls. Design of tied and propped walls. Anchors for sheet pile walls.

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 and apply the principles of geotechnical design based on Eurocode 7, considering limit states (ultimate & serviceability), to the design geotechnical structures.

C1 Develop a ground model from site investigation information and use this to identify characteristic values of properties.

C2 Identify a suitable design approach for the appropriate loading combinations and ground model.

C3 Optimise the design of geotechnical structures.

C4 Produce a concise geotechnical report.

LO2 Understand the principles governing the stability of slopes in various soil types, and design slopes.

C1 Analyse the stability of infinite slopes under different pore water pressure conditions.

C2 Analyse the stability of slopes under drained and undrained conditions using the method of slices.

C3 Design engineered slopes for different ground conditions using hand calculation and computer software.

C4 Understand the mechanisms of failure of natural slopes and strategies for landslide mitigation.

LO3 Understand the principles governing the stability of embedded walls in various soil types, and design embedded walls.

C1 Understand the behaviour of embedded walls and the influence of the water table.

C2 Analyse the stability of embedded walls under free-earth and fixed-earth conditions.

C3 Design embedded walls including the use of ground anchors to Eurocode 7.

LO4 Calculate the design bearing capacities of shallow foundations and pile foundations, taking account of foundation shape, load inclination, load eccentricity and ground conditions.

C1 Calculate the bearing capacity of shallow foundations under drained and undrained conditions.

C2 Calculate the bearing capacity of pile foundations under drained and undrained conditions.

C3 Design shallow and deep foundations to Eurocode 7.

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/>
)

Please state briefly how these are incorporated in this module.

Feedback will be provided to students individually and as a group through the tutorial sessions, which will include worked examples.

The coursework and exam will require out of class learning and library study

The coursework will have a clear set of marking criteria and standards of performance.

Coursework feedback will be provided in relation to the specific marking criteria set out in the coursework.

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

	Examinations			Courseworks		Projects		
	Number	Month(s)	Duration	Weighting	Number	Weighting	Number	Weighting
	2	December/ May	2hrs	35% each	TBC	30%		
L/Outcomes	LO1-4			LO1-4				

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

Coursework / Submissions deadlines (*academic weeks*):

Semester 1 (50% weighting in total)

CW1 Week 3 (indicative) – 3% Weighting

CW2 Week 5 (indicative) – 3% Weighting

CW3 Week 7 (indicative) – 3% Weighting

CW4 Week 10 (indicative) – 4% Weighting

The four short courseworks will all be submitted via MyPlace.

End of semester exam, of 2 hours duration (35% weighting). One exam at the end of semester 1 covering Topics 1, 2 and 3.

Semester 2 (50% weighting in total)

Coursework to be confirmed. (15% weighting)

End of semester exam, of 2 hours duration (35% weighting). One exam at the end of semester 2 covering Topics 4 and 5.

Resit Assessment Procedures:

2hr examination in August diet / Resubmission of coursework(s) prior to commencement of the August exam 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 exam / coursework / viva. No marks from any previous attempts will be transferred to a new resit attempt.

Recommended Reading

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

Essential Reading;

**Craig, R.F. & Knappett, J.A., *Craig's Soil Mechanics*, 8th edn., (2012) Spon Press, ISBN 978-0-415-56126-6.

Further reading;

**Powrie, W., *Soil Mechanics; Concepts and Applications*, 2nd edn., (2004), Spon Press, ISBN 0-415-31156-X.

**Atkinson, J.H., *Mechanics of Soils and Foundations*, 2nd edition (2007). CRC Press, ISBN 978-0-415-36256-6.

**Tomlinson, M.J., *Foundation Design and Construction*, 6th edition, Longman, 1995.

**CIRIA C580. Embedded retaining walls.

**EC7 and relevant British Standards (BS5930, 8002).

**Various papers, articles and brochures made available on MyPlace.

Additional Student Feedback

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

Date	Time	Room No
Weeks 1 - 11	Tuesday 11am	TBC

Session: 2022/23

Approved:

Course Director Signature:

Date of Last Modifications:

MODULE TIMETABLE

Module Code:

CL419

Module Title:

Geotechnical Engineering 2

Brief Description of Assessment:

Semester 1 (50% weighting in total)

CW1 Week 3 (indicative) – 3% Weighting

CW2 Week 5 (indicative) – 3% Weighting

CW3 Week 7 (indicative) – 3% Weighting

CW4 Week 10 (indicative) – 4% Weighting

The four short courseworks will all be submitted via MyPlace.

End of semester exam, of 2 hours duration (35% weighting). One exam at the end of semester 1 covering Topics 1, 2 and 3.

Semester 2 (50% weighting in total)

Coursework to be confirmed. (15% weighting)

End of semester exam, of 2 hours duration (35% weighting). One exam at the end of semester 2 covering Topics 4 and 5.

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.	Course work Submit Choose an item.	Course work Set Choose an item.	Course work Submit Choose an item.	Project Set Choose an item.	Course work Submit Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Course work Set Choose an item.	Course work Submit Choose an item.	Choose an item. Choose an item.

