COURSE DESCRIPTOR 2019/20

CL137 Fundamentals of Civil Engineering

Course Registrar: Dr Marcus Perry	**Taught To (Programme):** Civil Engineering & Civil and Environmental Engineering	
Other Lecturers Involved: Dr Philippe Sentenac	**Credit Weighting: 20**	**Semester: 1 and 2**
Assumed Pre-requisites:	**Compulsory**	**Academic Level: 1**

Course Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Coursework	Project	Private Study	**Total**
20	20	12	20		128	200

Course Aim(s)

This course introduces students to the behaviour, strengths and weaknesses of materials commonly used in civil engineering. The course covers fundamentals in continuum mechanics (mechanical and thermal stress and strain), the treatment of errors in civil engineering measurement, and the fabrication, physical / engineering properties and financial / carbon costs of materials. The materials covered in the module are steel, concrete, timber, glass, polymers, stone and soil.

Learning Outcomes

On completion of the course the student is expected to be able to;

LO1 Derive and apply the relationships between stress and strain in three dimensions.

LO2 Describe ductile, brittle and plastic material stress-strain behaviour

LO3 Understand the accuracy and precision of measurements made in civil engineering, and propagate errors

LO4 Demonstrate use of a process to design a concrete mix based on requirements for strength and workability

LO5 Describe the manufacture and physical characteristics of common civil engineering materials, and use key physical and engineering properties to calculate material suitability for basic applications

LO6 Calculate the embodied carbon and financial cost of getting materials to site

LO7 Describe the physical characteristics of soils used in civil engineering earthworks, and classify soils for engineering purposes, and how to report the results.

LO8 Determine the physical properties and phase relationships of soils.

LO9 Determine the compaction characteristics of soils, and how to report the results.

LO10 Understand the principles and processes used to form earthworks and determine basic quantities for simple earthwork projects

Syllabus

The course will teach the following;

Semester 1

Topic 1: Continuum Mechanics
Definitions and relationships between stress and strain (uniaxial, shear, bulk and thermal). Elastic and plastic behaviour, strength and stiffness. Ductile, plastic and brittle behaviour.

Topic 2: Materials: manufacturing, properties and cost
Manufacturing of concrete and steel. Historical developments and physical and engineering properties of major construction materials: concrete, steel, timber, polymers, bitumen and glasses. Embodied carbon and financial cost of civil engineering materials.

Topic 3: Civil engineering measurement
Measurements in civil engineering. Types of measurement – length, areas, volumes, movement, deformation. Measurement instruments. Units. Accuracy, precision, resolution and tolerance.

Semester 2

Topic 5: Introduction to soils and rocks and soil formation
Overview of soils and rocks in civil engineering. Physical characteristics of rock aggregates. Soil formation - physical and chemical weathering of rocks and the main soil minerals. Physical composition of soils.

Topic 6: Physical properties of soils
Engineering description of soils. Classification of coarse-grained and fine-grained soils. Phase relationships, between the various phases of soils.

Topic 7: Soil compaction and earthworks
Soil compaction: processes and controls used to produce engineering fills from different soils. Laboratory compaction tests.

Topic 8: Site investigation
Reasons for carrying out a site investigation. Sources of information. Types of maps and plans – ordnance survey, topographical, geological. The desk study. Ground exploration methods – boreholes and trial pits. Sampling and testing.

Assessment Criteria

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

LO1 Derive and apply the relationships between stress and strain in three dimensions.
C1 Can quantify the relationship between the force applied to an object and its deformation in 1D and 3D
C2 Ability to calculate the stress, strain, stiffness and Poisson's ratio of objects under loading

LO2 Describe ductile, brittle and plastic material stress-strain behaviour
C1 Can draw and explain stress-strain curves for elastic, plastic and brittle materials
C2 Can describe the macroscopic causes and effects of material creep and fatigue

LO3 Understand the accuracy and precision of measurements made in civil engineering, and propagate errors
C1 Can describe the difference between resolution, accuracy, precision and tolerance
C2 Can propagate errors for measurements derived from multiplication and division

LO4 Demonstrate use of a process to design a concrete mix based on requirements for strength and workability
C1 Understands the terminology and tests used to define the wet and cured properties of concrete
C2 Can use a mix-design process to design a concrete that meets specifications for strength and workability

LO5 Describe the manufacture and physical characteristics of common civil engineering materials, and use key physical and engineering properties to calculate material suitability for basic applications
C1 Can describe the main structural materials and their manufacture
C2 Can use thermal expansion coefficients to calculate thermal strain and stress
C3 Can define material hardness
C4 Can use material properties to define structural behaviour under constant uniaxial, shear, bulk and thermal loads

LO6 Calculate the embodied carbon and financial cost of getting materials to site
C1 Can describe the difference between CO2 and CO2e
C2 Can use the unit (carbon and financial) costs of materials and transport modes to calculate total costs of getting materials to site

LO7 Describe the physical characteristics of soils used in civil engineering earthworks, and classify soils for

engineering purposes, and how to report the results.

C1 Describe the tests used to classify soils.

C2 Classify soils according to recognised standards.

LO8 Determine shear strength under drained and undrained conditions from direct shear and triaxial test data.

C1 Understand that soil is a three-phase material.

C2 Calculate physical properties of soils.

LO9 Determine the compaction characteristics of soils, and how to report the results.

C1 Describe the process of compaction of soils.

C2 Determine the compaction characteristics of soils.

LO10 Understand the principles and processes used to form earthworks and determine basic quantities for

simple earthwork projects.

C1 Understand the principles of earthwork operations.

C2 Calculate simple earthwork masses and volumes

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

Principles of Assessment and Feedback
Please state briefly how these are incorporated in this module.

1. A range of assessment activities are used including tutorial work and laboratory testing and reporting. Model answers for assessment tasks are provided giving opportunities for students to make comparisons against their own work.
2. All assessments are clearly related to the learning outcomes and assessment feedback is provided against clearly stated criteria.
3. Assessments and methods are clearly explained to students at the start of the course.
4. The effectiveness of the assessment and feedback methods are reviewed at the end of the course and any recommended changes are implemented in the next academic year.

Recommended Reading

OpenStax College. University Physics, Volume 1. Rice University.
https://www.openstaxcollege.org/textbooks/university-physics

Taylor, G.D., Materials in Construction, 3rd Edn. (2000), Pearson Education, ISBN 0-582-36889-8.

Craig, R.F. & Knappett, J.A., Craig's Soil Mechanics, 8th Edn. (2012), Spon Press, ISBN 0-415-32703-2.

Evernden, M. (2016). Introduction to Structural Materials, Essential Knowledge Text No.6, Institution of Structural Engineers.

Evernden, M. (2016). Traditional Structural Materials, Essential Knowledge Text No.7, Institution of Structural Engineers.

Craig, R.F. (2005). *Soil Mechanics*, 7th edn., Spon Press ISBN 0-415-32703-2. Available online.

BS 1377 (1990). *Method of Test for Soils for Civil Engineering Purposes*, British Standards Institution, London.

BS 5930 (1999). *Code of Practice for Site Investigations*, British Standards Institution, London.

PLEASE NOTE:
Students need to gain a summative mark of 40% to pass the course. Students who fail the course at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of exam.

Resit Arrangements

Exam to be sat in August diet (100%)

Approved

Programme Director Signature:
Date of Last Modifications:

Assessment and Feedback Schedule – Semester 1

Class Code	CL137	Class Title	Fundamentals of Civil Engineering

Brief Description of Assessment

Laboratory Classes
Laboratory classes (10% weighting).
CL137 Lab 1: Tensile testing (5% - group report)
CL137 Lab 2: Concrete mix design (5% - group report)

The laboratories are carried out in groups of five students or less. See laboratory timetable for date and time of laboratories for each group.
Students must attend all laboratory classes and complete the laboratory work to a satisfactory standard.
Each group will answer an assignment sheet for each lab. This is explained in the laboratory handout.

Examinations
End of Semester 1 Exam, 2 Hour Duration (40% weighting).

Indicate in the tables below the Hand-Out (H), Submission (S) and Feedback (F) dates for each lab report/coursework/project and the timing of each Exam/Class Test (E), (T). Include duration of exam in brackets (e.g. E (2)).

Semester 1

Assessment type (& title)	LOs	Weight (%)	Individual / Group	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
Lab 1: tensile	3,4	5%	Group					H	S					F	
Lab 2: concrete	4-6	5%	Group							H	S			F	
Exam	All	40%	All Students												E (2h)

Assessment and Feedback Schedule – Semester 2

Class Code	CL137	Class Title	Fundamentals of Civil Engineering

Brief Description of Assessment

Laboratory Classes

Two individual laboratory reports (15% weighting).

CL137 Lab 3: Soil Classification Laboratory (10% - individual report)

CL137 Lab 4: Soil Compaction Laboratory (5% - individual report)

The laboratories are carried out in groups of four students. See laboratory timetable for date and time of laboratories for each group.

Students must attend all laboratory classes and complete the laboratory work to a satisfactory standard.

Each student will write an individual report for each lab. This is explained in the laboratory handout.

Examinations

End of Semester Exam, 2 Hours Duration (35% weighting).

Indicate in the tables below the Hand-Out (H), Submission (S) and Feedback (F) dates for each lab report/coursework/project and the timing of each Exam/Class Test (E), (T). Include duration of exam in brackets (e.g. E (2)).

Semester 2

Assessment type (& title)	LOs	Weight (%)	Individual / Group	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
Lab 3	7	10%	Groups 1-6				H		S			F			
Lab 3	7	10%	Groups 7-12				H		S			F			
Lab 3	7	10%	Groups 13-18					H		S		F			
Lab 3	7	10%	Groups 19-24					H		S		F			
Lab 4	9	5%	Groups 1-6						H		S			F	
Lab 4	9	5%	Groups 7-12						H		S			F	
Lab 4	9	5%	Groups 13-18							H		S		F	
Lab 4	9	5%	Groups 19-24							H		S		F	
Exam	7-10	35%	All Students												E (2h)