



Module Descriptor Form

Civil and Environmental Engineering

EO206 - Soils And Water 2

Module Code	EO206	Module Title	Soils And Water 2				
Module Registrar	Pedrotti, Dr Matteo						
Other Staff Involved	Mrs Sarah E Lavery (Lecturer)						
Credit Weighting	20	Semester	3	Elective	No	Academic Level	2
Pre-requisites							
Required for							

Module Format and Delivery (hours):

Lectures	Tutorials	Assignments	Labs	Private Study	Total
20	20	20	20	120	200

Educational Aim

This module aims to:

Develop an understanding of water and soil systems in the environment and the role of engineers in practice.

Revise basic fluid mechanics to provide introduction to hydraulics and to lay the foundation for subsequent classes in water engineering.

Introduce the governing principles of geotechnical engineering, in particular groundwater flow in soils and the principle of effective stress.

Syllabus

This module will teach the following:

Weeks 1 - 5

- Hydraulics Year 1 revision.
- Flow Visualisation: streamlines, pathlines and streamtubes.
- Conservation of Mass: Application of Conservation of Mass Principle to steady flow through pipes and nozzles, and the derivation of the Continuity Equation.
- Conservation of Momentum: application of the Linear Momentum Equation to steady flow through a nozzle and the calculation of forces on pipe bends.
- Bernoulli's Equation: application to steady flow through a pipe, and to a Water Siphon.
- An introduction to pipe flow: flow classification and energy diagrams applied to water supply systems.
- Flow Measuring Devices: Venturi meter, orifice plate and nozzle meter.
- The Energy Equation for open and closed systems, including the link to Bernoulli's Equation.
- Flow control by weirs and Venturi flumes: specific energy, specific energy diagrams and critical flow.

Weeks 6-11

- Soils Year 1 Revision
- Occurrence of water in soils
- Bernoulli's equation applied to soils
- Darcy's law for water flow
- Laboratory & field determination of hydraulic conductivity
- Water flow in homogenous & heterogeneous media
- Introduction to seepage theory: Laplace equation (graphical and numerical methods)
- Principle of effective stress
- Effective stress under hydrostatic conditions
- Concept of drained and undrained soil conditions
- Influence of seepage on effective stress
- Uplift pressure in geotechnical applications
- Liquefaction and critical hydraulic gradient
- Seepage related failures
- Methods to control groundwater flow and sustainable groundwater management

Learning Outcomes

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

LO: 1	Apply conservation equations to flows in pipes & horizontal open channels
LO: 2	Analyse flow measuring devices and control structures
LO: 3	Understand water flow in the ground and predict pore-water pressures under steady-state flow conditions
LO: 4	Understand the concept of effective stress in saturated soils and characterise the soil stress state resulting from hydraulic and mechanical loading.
LO: 5	Understand the importance of a sustainable groundwater control design

(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.)

Assessment of Learning Outcomes - Criteria

Learning Outcome: 1

	Criteria
1	Use of energy diagrams to describe a hydraulic system
2	Application of Bernoulli's equation to open channel & pipe flows
3	Calculation of forces on pipe bends and nozzles

Learning Outcome: 2

	Criteria
1	Application of the principles of the Venturi meter and other flow measuring devices
2	Use of specific energy diagram to describe open channel flow
3	Applications of critical depth, for weirs and channel contractions

Learning Outcome: 3

	Criteria
1	Calculate hydraulic conductivity from laboratory 1-D tests
2	Draw total head and pore water pressure profiles under 1-D flow conditions
3	Calculate hydraulic conductivity in layered soils
4	Use graphical method (hand-drawn) and hand-drawn method to produce 2-D flow nets for homogenous soil and use them to calculate seepage and pore-water pressures

Learning Outcome: 4

	Criteria
1	Calculate total stress, pore water pressure and effective stress profiles under hydrostatic conditions
2	Calculate effective stress under seepage conditions
3	Calculation of effective stress in response to changes in loading in coarse-grained and fine-grained soils
4	Ability to determine critical hydraulic gradient and predict failures due to zero effective stress conditions being reached

Learning Outcome: 5

	Criteria
1	Assessment of the awareness of the overall environmental consequences related to groundwater control techniques

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
Online Myplace Quiz. Open Book: Notes allowed as online Myplace quiz.	3		1.50	2%	1	
Online Myplace Quiz. Open Book: Notes allowed as online Myplace quiz.	3		1.50	2%	2	
Online Myplace Quiz. Open Book: Notes allowed as online Myplace quiz.	3		1.50	2%	3	
Online Myplace Quiz. Open Book: Notes allowed as online Myplace quiz.	3		1.50	2%	4	
Online Myplace Quiz. Open Book: Notes allowed as online Myplace quiz.	3		1.50	2%	5	
Online Myplace Quiz. Open Book: Notes allowed as online Myplace quiz.	3		1.50	2%	6	
Online Myplace Quiz. Open Book: Notes allowed as online Myplace quiz.	3		1.50	2%	7	
Lab A: Channel Controls	3	5		15%	7	
Virtual Lab B: Hydraulic Conductivity	3	7		5%	8	
Online Myplace Quiz. Open Book: Notes allowed as online Myplace quiz.	3		1.50	2%	8	
Online Myplace Quiz. Open Book: Notes allowed as online Myplace quiz.	3		1.50	2%	9	
Online Myplace Quiz. Open Book: Notes allowed as online Myplace quiz.	3		1.50	2%	10	
Virtual Lab C: Seepage	3	9		15%	11	
End of Course Exam. Closed Book	3		2.50	45%	E	

Principles of Assessment Feedback

See <https://www.strath.ac.uk/staff/policies/academic/>

Please state briefly how these are incorporated in this module.

Principle 1. Assessment and feedback practices promote effective student learning

1. Laboratory classes and coursework assignments are designed to focus student learning on key topics and learning material
2. Tutorial problems with answers to encourage and guide private study are provided .
3. Tutorial classes are held frequently for one-to-one interaction between instructors and students and timely feedback.

Principle 2. Assessment and feedback practices are appropriate, fair, and transparent

1. All assignments and assessments combine straightforward and challenging tasks.
2. Model solutions are provided for some coursework assignments.

Principle 3. Assessment and feedback practices are clearly communicated to students and staff

1. All assessed coursework assignments are open to view from the start of the course
2. All assessed coursework assignments are returned to students with feedback including annotations and comments.

Principle 4. Assessment and feedback practices are continuously reviewed

1. Interim student feedback is taken during each semester to review progress and resolve current issues; final semester student feedback taken upon completion of lecture courses to monitor student experience.
2. Coursework assignment and examination marks reviewed at end of year to monitor attainment and compared to student experience.

Additional Information

Resit Procedure

Students must gain a summative mark of 40% to pass the module. Attendance at the end of semester exam is a requirement of this module. Absence from the exam will result in an Absence being returned. Students who fail the module at the first attempt will be re-examined during the August resit diet. This re-examination will consist entirely of exam.

Term 3 resit: Formal examination in August with same format as in June.

NB: The August examination marks are 100% of the resit marks.

Recommended Reading

Required reading:

Knappet, J., Craig, R.F. (2012) Craig's Soil Mechanics, Eighth Edition, Spon Press ISBN 0-415-32703-2.

Hamil, L. (2011) Understanding Hydraulics, 3rd Ed, Palgrave MacMillan.

Recommended Reading:

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

Atkinson, John H Mechanics of Soils and Foundations, 2nd edition (2007). CRC Press, ISBN 9780415362566

Module Timetable

Week	Semester 1	Semester 2
0		
1		
2		
3		
4		
5		
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7		
8		
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Date of Last Modification

28-08-2025