



School of Civil and Environmental Engineering

Term 2, 2021

CVEN4202 ADVANCED TOPICS IN GEOTECHNICAL ENGINEERING

COURSE DETAILS

Units of Credit	6		
Contact hours	5 hours per week		
Class	Wednesday,	11:00 – 14:00	Online (weeks 1-4) and Online and Face to Face (weeks 5, 7-10)
	Friday,	10:00 – 12:00	Online (weeks 1-4) and Online and Face to Face (CE 201) (weeks 5, 7-10)

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INFORMATION ABOUT THE COURSE

Students enrolling in this HANDBOOK DESCRIPTION

See link to virtual handbook:

<https://www.handbook.unsw.edu.au/undergraduate/courses/2021/CVEN4202/>

OBJECTIVES

This course

TEACHING STRATEGIES

Private Study	<ul style="list-style-type: none"> Review lecture material and textbook Do set problems and assignments Join Moodle discussions of problems Reflect on class problems and assignments Download materials from Moodle Keep up with notices and find out marks via Moodle
Lectures	<ul style="list-style-type: none"> Find out what you must learn See methods that are not in the textbook Follow worked examples Hear announcements on course changes Ask questions
Workshops	<ul style="list-style-type: none"> Be guided by Demonstrators/Lecturers Practice solving set problems Ask questions
Assessments	<ul style="list-style-type: none"> Demonstrate your knowledge and skills Demonstrate higher understanding and problem solving
Laboratory Work	<ul style="list-style-type: none"> Hands-on work, to set studies in the context

EXPECTED LEARNING OUTCOMES

This course is designed to address the learning outcomes below and the corresponding Engineers Australia Stage 1 Competency Standards for Professional Engineers as shown. The full list of Stage 1 Competency Standards may be found in Appendix A.

After successfully completing this course, you should be able to:

Learning Outcome		EA Stage 1 Competencies
1.	<i>Understand the concept and applications of ground energy systems. To gain insights into designs and evaluations of these systems via hand calculations and computational modelling.</i>	1.1, 1.3, 1.4, 1.5, 2.1, 2.2
2.	<i>Understand the basic principles of heat and mass transfer in porous medium, to simulate soil systems hydro-thermal behaviour.</i>	1.1, 1.3, 1.4, 1.5, 2.1, 2.2
3.	<i>Using finite element method to solve geo-energy problems, including geothermal energy systems and their interaction with the ground.</i>	1.1, 1.3, 1.4, 1.5, 2.1, 2.2

For each hour of contact it is expected that you will put in at least 1.5 hours of private study.

COURSE PROGRAM

Term 2 2021

- Week 1 Introduction to shallow geothermal systems.
- Week 2 The common design approaches for shallow geothermal systems (analytical methods).
- Week 3 Heat and mass transfer mechanisms in the context of shallow geothermal systems (analytical solutions)
- Week 4 Introduction to thermal response testing (TRT) and energy geo-structures
Introduction to computational modelling of ground-energy systems

- Week 5 Introduction to the finite element package COMSOL Multiphysics (General heat and mass transfer modelling and analysis – computer lab)
- Week 6 Flexibility week for all courses (non-teaching)
- Week 7 Closed-loop vertical borehole heat exchangers (FE modelling – computer lab)
Assignment 2 briefing
- Week 8 Heat conduction and convection in porous medium (FE modelling – computer lab)
Project presentation
- Week 9 Shallow vs Deep geothermal systems (concepts and FE modelling, computer lab)
- Week 10 Underground urban heat island modelling (3D vs semi-3D methods)
Assignment 2 discussion and problem solving

ASSESSMENT OVERVIEW

Item	Topics	Weight	Learning outcomes assessed	Learning outcomes assessed	Due date	Deadline for absolute fail	Marks returned
Assignment 1	Energy Geotechnics Concept	10%	1, 3	Weeks 1,2 and 3	23 June 2021 11:59 pm	NA	26 th June 2021
Presentation	Energy Geo-						

RELEVANT RESOURCES

Part 1:

1. Banks, D. "An Introduction to Thermogeology", Wiley and Backwell, 2012.

