

## **CEE9533L – Geotechnical In-situ Testing**

**COURSE OUTLINE 2020-2021**

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### **DESCRIPTION**

Geotechnical engineers have a fascinating, yet occasionally confounding, job because they deal with inherently *variable* materials arranged by Nature – soil and rock. Karl Terzaghi once purportedly stated, “Nature has no contract with mathematics...” Similarly Peck (1972) stated, “In construction underground, where the engineer deals with materials having properties that vary not only in space but also in time, details of construction often have significant or even overwhelming influence on the behavior of the structure and of the surrounding soil. For an understanding of the behavior, these details must be observed and recorded.” As such, geotechnical engineers, perhaps more than any other branch of civil engineering, rely on physical (and preferably insitu) measurements of material (soil and rock) properties and behavior for use in engineering design and in the subsequent evaluation of engineering performance.

Therefore, the general objectives of this course are to: (1) introduce the observational method in geotechnical engineering; (2) introduce a broad range of in situ testing devices that students will encounter and use in practice; (3) provide a solid understanding of the applications and limitations of these devices through an examination of their theoretical, experimental, and empirical development; (4) introduce first-hand the use and interpretation of some of these devices, instrumentation, and measurements at real project sites and via selected important case histories; and (5) discuss emerging technologies and trends in in-situ testing. The course includes two written assignments and a term project.

### **PREREQUISITES**

This course is intended for graduate students enrolled in civil engineering with an interest in geotechnical engineering. It is expected that students will have advanced understanding of soil mechanics obtained by taking suitable courses at either the undergraduate or graduate level. Students without a suitable background in soil mechanics should discuss this with the instructor prior to registering for the course.

### **TOPICS**

<b>Topic #</b>	<b>Description</b>	<b>Learning Activities</b>	<b>Tentative timeline</b>
1	Introduction to Geotechnical Monitoring and Observational Method	Live discussion	Week 1

2	Drilling for Site Investigation and Sampling Methods		
3	Geophysical Methods for Site Investigation	Live discussion	Week 2
4	Field Hydraulic Conductivity Measurement		
5	Standard Penetration Test and Interpretation	Live discussion	Week 3
6	Cone Penetration Test and Interpretation	Live discussion	Week 4
7	Field Vane Shear test	Live discussion	Week 5
8	Pressuremeter Test		
9	Dilatometer and Goodman Jack	Live discussion	Week 6
10	Borehole shear test		
11	Plate load test	Live discussion	Week 7
12	Borehole shear test		
13	Emerging technologies		
	Project Presentations	Live student presentations	Week 8

### SPECIFIC LEARNING OUTCOMES

Degree Level Expectation	Weight	Assessment Tools	Outcomes
<b>Depth and breadth of knowledge</b>	30%	<ul style="list-style-type: none"> <li>• Assignments</li> <li>• Project</li> </ul>	<ul style="list-style-type: none"> <li>• Understanding of fundamentals of soil mechanics</li> <li>• In-depth understanding of in-situ testing and method</li> <li>• Understanding of computational and/or empirical methodologies to analysis in-situ testing data</li> </ul>
<b>Research &amp; scholarship</b>	15%	<ul style="list-style-type: none"> <li>• Project</li> </ul>	<ul style="list-style-type: none"> <li>• Ability to conduct critical evaluation of in-situ testing results</li> <li>• Incorporating in-situ testing data in numerical analysis of a geotechnical engineering problem</li> </ul>
<b>Application of knowledge</b>	30%	<ul style="list-style-type: none"> <li>• Assignments</li> <li>• Project</li> </ul>	<ul style="list-style-type: none"> <li>• Ability to apply knowledge in a rational way to analyze a in-situ testing data</li> <li>• Ability to use coherent approach to design a particular engineering system using existing in-situ data</li> </ul>
<b>Professional capacity / autonomy</b>	5%	<ul style="list-style-type: none"> <li>• Project</li> </ul>	<ul style="list-style-type: none"> <li>• Awareness of academic integrity</li> <li>• Ability to implement established procedures and practices in the coursework</li> <li>• Defends own ideas and conclusions</li> <li>• Integrates reflection into his/her learning process</li> </ul>
<b>Communication skills</b>	10%	<ul style="list-style-type: none"> <li>• Project</li> </ul>	<ul style="list-style-type: none"> <li>• Ability to communicate (oral and/or written) ideas, issues, results and conclusions clearly and effectively</li> </ul>

<b>Awareness of limits of knowledge</b>	10%	<ul style="list-style-type: none"> <li>• Project</li> </ul>	<ul style="list-style-type: none"> <li>• Awareness of the need of assumptions in complex scientific analyses and their consequences</li> <li>• Understanding of the difference between theoretical and empirical approaches</li> <li>• Ability to acknowledge analytical limitation due to complexity of practical problems</li> </ul>
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## ASSESSMENTS

Assessment Type	Material Covered	Due Date	Weight
Homework Assignments	Topics 3 to 12	July 26 <sup>th</sup> & August 16 <sup>th</sup>	40%
Project report	Topics 1 to 13	August 23 <sup>rd</sup>	40%
Project presentation	Topics 1 to 13	August 23 <sup>rd</sup>	20%

### Live Lectures

The course will be delivered asynchronously. Students are expected to watch pre-recorded videos of each lecture. The lecture times will be spent on discussing relevant subject(s) and answering questions.

### Activities in which collaboration is permitted:

None

### Activities in which students must work alone (collaboration is not permitted):

- Homework assignment
- Project report
- Project presentation

## CONTACT INFORMATION

Course instructor: Professor Abouzar Sadrekarimi

Email address: [asadrek@uwo.ca](mailto:asadrek@uwo.ca)

### Contact policy:

- Contact instructor via email (above) or through messages in OWL
- Weekly Office hours are held via Zoom

## OPTIONAL COURSE READINGS

Due to the practical nature of this course there are also a number of other textbooks and standard codes that cover many of the aspects of the course material and which are available through Western Libraries, either physically or online. These include:

Clayton, C. R. I., Matthews, M. C. and Simons, N. E. (1995). "Site Investigation" 2nd Edition, Blackwell Science. Prepared class notes will be made available through the course OWL site at <http://owl.uwo.ca/>, along with other useful reference material and data for assignments.

Terzaghi, K., Peck, R., and Mesri, G. (1996). "Soil mechanics in engineering practice."  
John Wiley & Sons, 592 pages.

## **COURSE CONTENT**

The lecture notes and online lecture videos are copyrighted to the instructor and legally protected. Do not post these videos and lecture notes on any other website or online forums. The recording of the live/synchronous sessions of the course without the permission from the instructor is prohibited. The illegal posting and sharing of the copyrighted course content could be subjected to legal actions.

## **CHEATING, PLAGIARISM/ACADEMIC OFFENCES**

Academic integrity is an essential component of learning activities. Students must have a clear understanding of the course activities in which they are expected to work alone (and what working alone implies) and the activities in which they can collaborate or seek help; see information above under "Assessments" and ask instructor for clarification if needed. Any unauthorized forms of help-seeking or collaboration will be considered an academic offense. University policy states that cheating is an academic offence. If you are caught cheating, there will be no second warning. Students must write their essays and assignments in their own words. Whenever students take an idea or a passage of text from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence. Academic offences are taken seriously and attended by academic penalties which may include expulsion from the program. Students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence (see Western's scholastic discipline regulations for graduate students).

## **SYNCHRONOUS LEARNING ACTIVITIES**

Students are expected to participate in synchronous learning activities as outlined in the course syllabus and/or described by the instructor. If you have issues that will impede your ability to participate in synchronous activities, please discuss with the course instructor at the beginning of the course.

## **CONDUCT**

Students are expected to follow proper etiquette during synchronous and asynchronous activities to maintain an appropriate and respectful academic environment. Any student who, in the opinion of the instructor, is not appropriately participating in the synchronous and asynchronous learning activities and/or is not following the rules and responsibilities associated with the online learning activities, will be reported to the Associate Dean (Graduate) (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Associate Dean (Graduate), the student could be debarred from completing the assessment activities in the course as appropriate.

## **HEALTH/WELLNESS**

As part of a successful graduate student experience at Western, we encourage students to make their health and wellness a priority. Western provides several health and wellness related services (remotely accessible) to help you achieve optimum health and engage in healthy living while

pursuing your graduate degree. Information regarding health- and wellness-related services available to students may be found at <http://www.health.uwo.ca/>.

Students seeking help regarding mental health concerns are advised to speak to someone they feel comfortable confiding in, such as their faculty supervisor, their program director (graduate chair), or other relevant administrators in their unit. Campus mental health resources may be found at [http://www.health.uwo.ca/mental\\_health/resources.html](http://www.health.uwo.ca/mental_health/resources.html)  
<https://www.uwo.ca/health/psych/index.html>

### **SICKNESS**

Students should immediately consult with the Instructor (for a particular course) or Associate Chair (Graduate) (for a range of courses) if they have problems that could affect their performance. The student should seek advice from the Instructor or Associate Chair (Graduate) regarding how best to deal with the problem. Failure to notify the Instructor or the Associate Chair (Graduate) immediately (or as soon as possible thereafter) will have a negative effect on any appeal. Obtaining appropriate documentation (e.g., a note from the doctor) is valuable when asking for accommodation due to illness.

### **ACCESSIBILITY**

Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Accessible Education at 661-2111 x 82147 or [http://academicsupport.uwo.ca/accessible\\_education/index.html](http://academicsupport.uwo.ca/accessible_education/index.html), for any specific question regarding an accommodation.