Western University
Faculty of Engineering
Department of Civil and Environmental Engineering

CEE9533L – Geotechnical In-situ Testing

COURSE OUTLINE 2022-2023

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.

ENROLLMENT RESTRICTIONS

Enrollment in this course is restricted to graduate students in Civil and Environmental 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.

INSTRUCTOR CONTACT INFORMATION

Course instructor: Abouzar Sadrekarimi, PhD, PEng
Email address: asadrek@uwo.ca
Office: SEB3010D
Office hours: Fridays 1:00 to 3:00 pm

TOPICS

Topic #	Description	Learning Activities	Tentative timeline
1	Introduction to Geotechnical Monitoring and Observational Method	Lectures & Discussion Additional reading	Week 1
2	Drilling for Site Investigation and Sampling Methods	Lectures & Discussion Additional reading	Week 2
3	Geophysical Methods for Site Investigation	Lectures & Discussion Additional reading	Week 3
4	Field Hydraulic Conductivity Measurement		
5	Standard Penetration Test and Interpretation	Lectures & Discussion Additional reading	Week 4
6	Cone Penetration Test and Interpretation	Lectures & Discussion Additional reading	Weeks 5, 6, 7
No Class - Reading Week (October 31st to November 4th)			Week 8
7	Field Vane Shear test	Lectures & Discussion Additional reading	Week 9
8	Pressuremeter Test		
9	Dilatometer and Goodman Jack	Lectures & Discussion Additional reading	Week 10
10	Borehole shear test		
11	Plate load test	Lectures & Discussion Additional reading	Week 12
12	Borehole shear test		
13	Emerging technologies		
	Project Presentations	Student presentations	Weeks 12, 13

SPECIFC LEARNING OUTCOMES

Degree Level Expectation	Weight	Assessment Tools	Outcomes
Depth and breadth of knowledge	30%	• Assignments • Project	• Understanding of fundamentals of soil mechanics • In-depth understanding of in-situ testing and method • Understanding of computational and/or empirical methodologies to analysis in-situ testing data
Research & scholarship	15%	• Project	• Ability to conduct critical evaluation of in-situ testing results • Incorporating in-situ testing data in numerical analysis of a geotechnical engineering problem
Application of knowledge	30%	• Assignments • Project	• Ability to apply knowledge in a rational way to analyze a in-situ testing data • Ability to use coherent approach to design a particular engineering system using existing in-situ data
Professional capacity / autonomy	5%	• Project	• Awareness of academic integrity • Ability to implement established procedures and practices in the coursework

			• Defends own ideas and conclusions • Integrates reflection into his/her learning process
Communication skills	10%	• Project	• Ability to communicate (oral and/or written) ideas, issues, results and conclusions clearly and effectively
Awareness of limits of knowledge	10%	• Project	• Awareness of the need of assumptions in complex scientific analyses and their consequences • Understanding of the difference between theoretical and empirical approaches • Ability to acknowledge analytical limitation due to complexity of practical problems

ASSESSMENTS

Assessment Type	Material Covered	Tentative due date	Weight
Homework #1	Topics 1 & 2	Sept. 30th	10%
Homework #2	Topic 3	Oct. 14th	15%
Homework #3	Topics 5 to 7	Nov. 18th	15%
Project report	Topics 1 to 13	Dec. 2nd	40%
Project presentation	Topics 1 to 13	Nov. 25th & Dec. 2nd	20%

Activities in which collaboration is permitted:

None

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

- Homework assignment
- Project report
- Project presentation

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 are copyrighted to the instructor and legally protected. Do not post these 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.

COURSE FORMAT

This course will be delivered **in-person**.

In the event of a COVID-19 resurgence during the course that necessitates the course delivery moving away from face-to-face interaction, all remaining course content will be delivered entirely online, either synchronously (i.e., at the times indicated in the timetable) or asynchronously (e.g., posted on OWL for students to view at their convenience). The grading scheme will not change. Any remaining assessments will also be conducted online at the discretion of the course instructor.

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).

All required papers may be subject to submission for textual similarity review to the commercial plagiarism-detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (http://www.turnitin.com).

CONDUCT

Students are expected to follow proper etiquette to maintain an appropriate and respectful academic environment. Any student who, in the opinion of the instructor, is not appropriately participating in course activities and/or is not following the rules and responsibilities associated with the course 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 SERVICES

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 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. Faculty of Engineering has a Student Wellness Counsellor. To schedule an appointment with the counsellor, contact Kristen Edwards (khunt29@uwo.ca) via confidential email and you will be contacted by our intake office within 48 hours to schedule an appointment.

Students who are in emotional/mental distress should refer to Mental Health@Western: http://www.uwo.ca/uwocom/mentalhealth/ for a complete list of options about how to obtain help.

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.

Students who are not able to meet certain academic responsibilities due to medical, compassionate or other legitimate reason(s), could request for academic consideration. The Graduate Academic Accommodation Policy and Procedure details are available at:
https://www.eng.uwo.ca/graduate/current-students/academic-support-and-accommodations/index.html

ACCESSIBLE EDUCATION WESTERN (AEW)

Western is committed to achieving barrier-free accessibility for all its members, including graduate students. As part of this commitment, Western provides a variety of services devoted to promoting, advocating, and accommodating persons with disabilities in their respective graduate program. Graduate students with disabilities (for example, chronic illnesses, mental health conditions, mobility impairments) are strongly encouraged to register with Accessible Education Western (AEW): http://academicsupport.uwo.ca/accessible_education/index.html
AEW is a confidential service designed to support graduate and undergraduate students through their academic program. With the appropriate documentation, the student will work with both AEW and their graduate programs (normally their Graduate Chair and/or Course instructor) to ensure that appropriate academic accommodations to program requirements are arranged. These

accommodations include individual counselling, alternative formatted literature, accessible campus transportation, learning strategy instruction, writing exams and assistive technology instruction.