Introduction
This course is intended to extend the core knowledge and understanding of the mechanics of soils that were developed in courses CEE3321/3322. Students will be introduced to commonly encountered geotechnical engineering systems (pure soil and composite) and the approaches required for their design. The concepts and methodology of site investigation will also be introduced. The students will be able to analyze and interpret the laboratory test, field test and borehole data presented in geotechnical reports to select appropriate design parameters. They will be able to select suitable analytical methods to predict the behaviour of a range of geotechnical structures, interpret the results of these predictions and make rational design decisions based on the results. They will improve their communication skills by documenting design decisions in coherent and legible design calculations. The students will develop problem-solving skills while working individually or as members in a group. The students will employ relevant software packages in their designs. They will develop an understanding of the impact of engineering on non-technical issues.

Calendar Copy
Application of shear strength, effective stress, and earth pressure theories to the design of shallow and deep foundations, earth slopes, braced cuts, and retaining structures and related safety issues.

Prerequisites
CEE3322/21 or the former CEE3326

Corequisites
None.

Antirequisites
The former ES426a

Note: It is the student’s responsibility to ensure that all Prerequisite and Corequisite conditions are met or that special permission to waive these requirements has been granted by the Faculty. It is also the student’s responsibility to ensure that they have not taken a course listed as an Antirequisite. The student may be dropped from the course or not given credit for the course towards their degree if they violate the Prerequisite, Corequisite or Antirequisite conditions.

Contact Hours
- 3 lecture hours/week (Mon, Wed and Thur):
  Lectures will be delivered in class.

- 2 tutorial hours/week (Wed):
  Tutorial and design sessions will be delivered in class
Instructor
Associate Prof. Tim Newson (newson@eng.uwo.ca), SEB 3084.

Office hours: To be discussed in class.
Admin Support: Sandra McKay (smckay@uwo.ca), SEB 3005.

Textbook
Prepared class notes should be brought to each class and can be downloaded from the course website (http://owl.uwo.ca).

Other References
The following books form a useful additional source of reference materials:


Laboratory
None.

Units
SI units will be used in teaching, design project, tutorials and final exam.

General Learning Objectives

**E=Evaluate, T=Teach, I=Introduce; (D) = Developing, (A) = Advanced level**

<table>
<thead>
<tr>
<th>Knowledge Base</th>
<th>E (A)</th>
<th>Engineering Tools</th>
<th>E (A)</th>
<th>Impact on Society</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem Analysis</td>
<td>E (A)</td>
<td>Teamwork</td>
<td>T</td>
<td>Ethics and Equity</td>
</tr>
<tr>
<td>Investigation</td>
<td>E (A)</td>
<td>Communication</td>
<td>I</td>
<td>Economics and Project Management</td>
</tr>
<tr>
<td>Design</td>
<td>E (A)</td>
<td>Professionalism</td>
<td>I</td>
<td>Life-Long Learning</td>
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Specific Learning Objectives

The specific objectives of the course are:

1. *Site Investigation:*

   By the end of this section, the students will be able to:

   i) Describe the purpose and structure of typical geotechnical site investigations.

   ii) Describe the methods available for ground exploration and for retrieving samples from site.

   iii) Understand the use of field and laboratory tests for determining parameters for geotechnical design.
iv) Design a suitable site investigation for a given geotechnical structure.

2. *Shallow Foundations:*

   By the end of this section, the students will be able to:

   i) Describe the difference between ultimate and allowable bearing capacity, and reasons for the different approaches to apply factors of safety.

   ii) Describe the factors considered in the general bearing capacity equation and use it to calculate the bearing capacity.

   iii) Identify the cases where the assumptions of the general bearing capacity equation are not valid and apply proper correction factors for these cases.

   iv) Design shallow foundations on clay or sand that satisfy the allowable bearing capacity requirements based on soil properties interpreted from laboratory tests or field investigations.

   v) Determine the distribution of stress increase underneath the foundation due to its load.

   vi) Design shallow foundations that satisfy the short and long-term settlement requirements.

3. *Deep Foundations:*

   By the end of this section, the students will be able to:

   i) Describe the load-carrying mechanisms for piles.

   ii) Describe different types of piles and installation methods.

   iii) Design single piles and pile groups that satisfy the bearing capacity requirements.

   iv) Calculate the settlement of single piles.

   v) Design pile groups that satisfy the settlement requirements.

4. *Retaining walls:*

   By the end of this section, the students will be able to:

   i) Calculate the distribution of lateral earth pressure at rest.

   ii) Describe the different theories of lateral earth pressure and their assumptions, and use Rankine and Coulomb theories to calculate the distribution of lateral earth pressure acting on retaining walls.

   iii) Design concrete retaining walls including consideration of different failure modes such as overturning, sliding, bearing capacity and general stability; and determine the factor of safety of the wall against each of these failure modes.

   iv) Design sheet pile walls including cantilever and anchored types.

*The instructor may expand or revise material presented in the course as appropriate.*
Evaluation
The final grade is computed as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Assignment Problems</td>
<td>24%</td>
</tr>
<tr>
<td>Design Project and Report</td>
<td>36%</td>
</tr>
<tr>
<td>Final Examination</td>
<td>40%</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

1. The mark for the design project shall be multiplied by the number of group members and the product allocated to the members in proportion to each member's contribution to the work. At the end of the course, group members must individually recommend (in the appropriate form), a suitable allocation to be used. A summary of the work done by each member (with reference to the three design project reports) must be attached to the final report submission.

2. Criteria for the various coursework submissions are described later in this document.

3. The penalty for late submission of coursework shall be 10% per day; thus, if any submission is more than 5 days late it cannot receive a passing grade.

4. Students who have failed this course previously must repeat all components of the course. No special permissions will be granted enabling a student to retain design project, assignment or test marks from previous years. Previously completed assignments and design project reports cannot be resubmitted.

1. **Examinations**
A three-hour closed book final examination will be held during the regular examination period. Only approved programmable calculators are permitted in the final exam. Students should consult the list of approved calculators outside the Departmental Office. To get approval to use a calculator not on the list you must consult with Dr. Newson at least three weeks prior to the quiz/exam where you wish to use the calculator.

2. **Coursework**
There will be a group geotechnical design project that is sub-divided into three parts. Groups will be assigned by the instructor at the start of the project. The overall solution to the design and the report is worth 36% of the final assessment mark.

Tutorial question sheets will be given out during the course. These will **not be assessed**, but have the aim of familiarizing students with the topics covered during the lectures and preparing them for the end of year examination. Three short design assignments (8% each) will be assessed and individual submissions are required.

Assignments and components of the design project are to be submitted online to OWL by the due date. Assessed coursework will be marked and returned as soon as possible.

3. **English**
In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests and examinations for the improper use of English. Additionally, poorly written work with the exception of final examinations may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.
**Cheating**
University policy states that cheating is a scholastic offence. The commission of a scholastic offence is attended by academic penalties that might include expulsion from the program. If you are caught cheating, there will be no second warning. For more information on scholastic offenses, please see: [http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_undergrad.pdf](http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_undergrad.pdf).

**Attendance**
Any student who, in the opinion of the instructor, has not engaged sufficiently in class, or tutorial periods will be reported to the Dean (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Dean, the student will be debarred from taking the regular final examination in the course.

**Accommodation**
Students with disabilities work with Accessible Education (formerly SSD) which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The accommodation policy can be found here: [Academic Accommodation for Students with Disabilities](http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_undergrad.pdf).

**Academic Consideration for Student Absence**
Students will have up to two (2) opportunities during the regular academic year to use an on-line portal to self-report an absence during the term, provided the following conditions are met: the absence is no more than 48 hours in duration, and the assessment for which consideration is being sought is worth 30% or less of the student’s final grade. Students are expected to contact their instructors within 24 hours of the end of the period of the self-reported absence, unless noted on the syllabus. Students are not able to use the self-reporting option in the following circumstances:

- for exams scheduled by the Office of the Registrar (e.g., December and April exams)
- absence of a duration greater than 48 hours,
- assessments worth more than 30% of the student’s final grade,
- if a student has already used the self-reporting portal twice during the academic year

If the conditions for a Self-Reported Absence are not met, students will need to provide a Student Medical Certificate if the absence is medical, or provide appropriate documentation if there are compassionate grounds for the absence in question. Students are encouraged to contact their Faculty academic counselling office to obtain more information about the relevant documentation. Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. All documentation required for absences that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling office of a student's Home Faculty.

For Western University policy on Consideration for Student Absence, see the [Policy on Academic Consideration for Student Absences - Undergraduate Students in First Entry Programs](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf) and for the Student Medical Certificate (SMC), see: [http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf).

**Religious Accommodation**
Students should consult the University's list of recognized religious holidays, and should give reasonable notice in writing, prior to the holiday, to the Instructor and an Academic Counsellor if their course requirements will be affected by a religious observance. Additional information is given in the [Western Multicultural Calendar](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf).
Use of Recordings
All of the remote learning sessions for this course will be recorded. The data captured during these recordings may include your image, voice recordings, chat logs and personal identifiers (name displayed on the screen). The recordings will be used for educational purposes related to this course, including evaluations. The recordings may be disclosed to other individuals under special circumstances. Please contact the instructor if you have any concerns related to session recordings. Participants in this course are not permitted to record the sessions, except where recording is an approved accommodation, or the participant has the prior written permission of the instructor.

Conduct
Students are expected to arrive at lectures on time, and to conduct themselves during class in a professional and respectful manner that is not disruptive to others. Please turn off your cell phone before coming to a class, tutorial or exam. On the premises of the University or at a University-sponsored program, students must abide by the Student Code of Conduct: http://www.uwo.ca/univsec/board/code.pdf.

Some components of this course, particularly the tutorial or design sessions, may involve online interactions. To ensure the best experience for both you and your classmates, please honour the following rules of etiquette:

• please “arrive” to class on time.
• please use your computer and/or laptop if possible (as opposed to a cell phone or tablet).
• ensure that you are in a private location to protect the confidentiality of discussions in the event that a class discussion deals with sensitive or personal material.
• to minimize background noise, kindly mute your microphone for the entire class until you are invited to speak, unless directed otherwise.
• in order to give us optimum bandwidth and web quality, please turn off your video camera for the entire class unless you are invited to speak.
• please be prepared to turn your video camera off at the teaching assistant/instructor’s request if the internet connection becomes unstable. unless invited by your teaching assistant/instructor, do not share your screen in a meeting. The course teaching assistant/instructor will act as moderator for the class and will deal with any questions from participants. To participate please consider the following:

a) if you wish to speak, use the “raise hand” function and wait for the instructor to acknowledge you before beginning your comment or question.

b) remember to unmute your microphone and turn on your video camera before speaking.

c) self-identify when speaking.

d) remember to mute your mic and turn off your video camera after speaking (unless directed otherwise).

General considerations of “netiquette”:
• Keep in mind the different cultural and linguistic backgrounds of the students in the course.
• Be courteous toward the teaching assistant/instructor, your colleagues, and authors whose work you are discussing.
• Be respectful of the diversity of viewpoints that you will encounter in the class and in your readings. The exchange of diverse ideas and opinions is part of the scholarly environment. “Flaming” is never appropriate.
• Be professional and scholarly in all online postings. Cite the ideas of others appropriately.
Note that disruptive behaviour of any type during online classes, including inappropriate use of the chat function, is unacceptable. Students found guilty of Zoom-bombing a class or of other serious online offenses may be subject to disciplinary measures under the Code of Student Conduct.

**Contingency Plan for COVID-19**

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 as determined by the course instructor. In the event that online learning is required, a stable internet connection with working microphone and webcam will be required. As has been the case in the past, the decision to pivot to online learning will be made by Western, and not individual instructors/departments (excepting temporary online instruction in the event of instructor illness).

**Masking Guidelines**

Students will be expected to wear triple layer, non-medical, paper masks at all times in the classroom as per University policy and public health directives. Students who are unable to wear a mask must seek formal accommodation through Western Accessible Education, and present medical documentation. Students are not permitted to eat or drink while in class to ensure masks stay in place. Students will be able to eat and drink outside of the classroom during scheduled breaks. *Students unwilling to wear a mask as stipulated by Western policy and public health directives will be referred to the Dean, and such actions will be considered a violation of the student Code of Conduct.*

**Course Absences due to Daily COVID Screening Questionnaire**

Missed assessments (e.g., presentations, essays, quizzes, tests, midterms, etc.) require formal academic considerations (typically self-reported absences and/or academic counselling). Methods for dealing with missed work and course content are at the discretion of the instructor. Students should be aware that some learning outcomes cannot be easily made up and may need to be completed in a subsequent year. The instructor will provide you with further information as to how this applies within this course. *Students who demonstrate a pattern of routinely missing coursework due to self-reported COVID symptoms, and therefore do not demonstrate mastery of the learning outcomes of the course, will not receive credit for the course.*

**Notices**

Students are responsible for regularly checking their email, course website (https://owl.uwo.ca) and notices posted outside the Civil and Environmental Engineering Department Office.

**Consultation**

Students are encouraged to discuss problems with their teaching assistant and/or the instructor in tutorial sessions. Office hours (online) will be arranged for the students to meet with the instructor and teaching assistants. Other individual consultation can be arranged by appointment with the instructor.

**Course Breakdown**

Total = 44.11 AU’s

Engineering Science = 25% or 11.03 AU’s; Engineering Design = 75% or 33.08 AU’s

The document “INSTRUCTIONS FOR STUDENTS UNABLE TO WRITE TESTS OR EXAMINATIONS OR SUBMIT ASSIGNMENTS AS SCHEDULED” is part of this course outline.