Objectives and Scope:
Modern retaining structures that support soils at slopes steeper than their angle of repose, are constructed of a broad range of materials, such as masonry, mass concrete, reinforced concrete, pre-cast concrete, timber, metal, and geo-synthetics. Retaining walls are classified based on their styles, such as gravity walls, semi-gravity walls, cantilever walls, counter-fort walls, crib walls, reinforced soil walls, sheet-pile walls and braced excavation. Regardless the type and material of an earth retaining structure, two requirements must be satisfied in the design, i.e., the external stability and internal stability under various loading and environmental conditions.

The Objectives of this course is to introduce the principles and methodologies of design and analysis of common earth retaining structures. Case studies are used to enhance the learning process. The specific learning objectives include:

- Carry out preliminary design of rigid and flexible retaining walls;
- Assess the external and internal stability of an existing retaining wall under various loading and environmental conditions;
- Develop strategy and approach on improving the stability of existing retaining walls;
- Conduct forensic analysis for retaining wall failures.

This course will cover the following topics:

1. Theories and general design considerations
   - Fundamental assumptions
   - Rankine’s theory
   - Coulomb’s theory
   - Seismic loading
   - Seepage
   - Frost action
   - Foundations
   - Backfills
   - Drainage
   - Internal stability
   - External stability

2. Rigid Retaining Structures
   - Gravity walls
   - Cantilever walls

3. Flexible Retaining Structures
   - Mechanically stabilized earth (MSE) walls
   - Cantilever sheet Pile walls
   - Anchored sheet pile walls
   - Braced cuts
Prerequisite: This course is intended for graduate students enrolled in civil and environmental engineering with an interest in geotechnical engineering and/or structural engineering. It is expected that students have knowledge of soil mechanics, geotechnical engineering design and structural analysis at the undergraduate level. Students without a suitable background in civil engineering should discuss with the instructor prior to registering the course.

Corequisite: None

Antirequisite: None

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.

Instructor: Dr. Julie Q. Shang, P.Eng. SEB 3082, email: jqshang@uwo.ca. Administrative Support: SEB 3005

Contact Hours: One lecture (Three hours) per week, 2019-9-19 to 2019-11-28.

Course Materials:
References:
Canadian Foundation Engineering Manual (CFEM 2007)
Other references are posted on the course web site.

Course notes:
Posted on the course site at http://owl.uwo.ca/

Computing:
Design and analysis in assignments and project require spreadsheets and software SlopeW (GeoStudio2018 available at WE computer lab). Students can use other commercially available software for programming, calculation and analysis.

Units:
SI units will be used in lectures, presentations and project reports.

Evaluation: The course mark will be determined as follows (a student must achieve at least 25 marks for the final project report to pass the course)

<table>
<thead>
<tr>
<th>Attendance</th>
<th>10</th>
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<tr>
<td>Assignments</td>
<td>30</td>
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<tr>
<td>Project presentation</td>
<td>10</td>
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<tr>
<td>Final Project report</td>
<td>50</td>
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Use of English:
In accordance with Senate and Faculty Policy, students may be penalised 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 the final examination 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.

Scholastic Offences:
Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site: http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_grad.pdf.

Plagiarism:
University policy states that plagiarism, defined as the “act or an instance of copying or stealing another’s words or ideas and attributing them as one’s own.” (excerpted from Black’s Law Dictionary, West Group, 1999, 7th ed., p. 1170) is a scholastic offence. In submitting any written work as part of the coursework requirements for this course students must ensure that this work is written 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.

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).

A student who is found guilty of plagiarism in respect of any written work submitted as part of the coursework requirements for this course will be given a grade of zero for the submitted work. Repeated acts of plagiarism, either in this course or any other course subsequent to a first offence, will result in the student being given a failing grade for the course in which the subsequent offence occurs, and may also incur further penalties such as requiring the student to withdraw from the program in which they are enrolled in.

Attendance:
Any student who, in the opinion of the instructor, is absent too frequently from class, laboratory, 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.

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 Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.

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. Late comers may be asked to wait outside the classroom until being invited in by the Instructor. Please turn off your cell phone before coming to a class, tutorial, quiz 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](http://www.uwo.ca/univsec/board/code.pdf).

**Sickness and Other Problems:**
Students should immediately consult with the Instructor or Department Chair if they have any problems that could affect their performance in the course. Where appropriate, the problems should be documented (see attached). The student should seek advice from the Instructor or Department Chair regarding how best to deal with the problem. Failure to notify the Instructor or Department Chair immediately (or as soon as possible thereafter) will have a negative effect on any appeal.


**Notice:**
Students are responsible for regularly checking their email, and the course OWL site for new notices related to the course.

[https://grad.uwo.ca/administration/regulations/6.html](https://grad.uwo.ca/administration/regulations/6.html)

**6.02 STATEMENT ON STUDENT ACCESSIBILITY SERVICES (SAS) TO BE INCLUDED ON COURSE OUTLINES**
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 encouraged to register with Student Accessibility Services, a confidential service designed to support graduate and undergraduate students through their academic program. With the appropriate documentation, the student will work with both SAS 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.

For more information, see [http://www.sdc.uwo.ca/ssd/](http://www.sdc.uwo.ca/ssd/)