

**University of Western Ontario**  
**Faculty of Engineering**  
**Department of Civil and Environmental Engineering**

**CEE 9511L – Design and Analysis of Earth Retaining Structures**  
**Course Outline – 2017ST**

**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:

**Theoretical Aspects**

- Fundamental assumptions
- Rankine's theory
- Coulomb's theory
- Seismic loading
- Seepage
- Frost action

**General Design Considerations**

- Foundation
- Active and passive earth pressure
- Backfill
- Drainage
- Internal stability
- External stability
- Retaining Structures in the Canadian Codes of Design
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**Design of Rigid Structures**

- Gravity walls
- Cantilever walls

**Design of Flexible Structures**

- Mechanically stabilized earth (MSE) walls
- Cantilever sheet Pile walls
- Anchored sheet pile walls
- Braced cuts

**Case Studies: Failures and rehabilitations of retaining walls**

**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

**Total Number of Contact Hours:**

Three lecture hours per week, July 7 – Aug 27, 2017.

**Course Materials:**

References:

Canadian Foundation Engineering Manual (CFEM 2007)

Budhu, M. 2008. Foundations and earth retaining structures, John Wiley and Sons, NY.

Course notes:

Class notes will be on the course OWL site at <http://owl.uwo.ca/>, along with other references and assignments.

**Computing:**

Design and analysis in assignments and project require spreadsheets, and students can choose any software for programming, calculation and analysis.

**Units:**

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

**Evaluation:**

The final course mark will be determined as follows:

Attendance:	20%
Presentation:	30%
Final Project:	50%
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Total	100%

**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](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>.

**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.

For more information concerning medical accommodations, please see:  
[http://www.uwo.ca/univsec/handbook/appeals/accommodation\\_medical.pdf](http://www.uwo.ca/univsec/handbook/appeals/accommodation_medical.pdf).

**Notice:**

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