Objectives: To develop understanding of the concepts, theories and procedures of geotechnical earthquake engineering. The students will learn to analyze the ground response during earthquake, assess the liquefaction potential and seismic stability of slopes and retaining walls.

Topics: - Introduction: seismology and earthquakes, seismic waves, size of earthquakes and ground motion parameters.
- Wave propagation: one-dimensional and multi-dimensional wave propagation, surface and multi-layered soil wave systems.
- Dynamic soil properties: Field and laboratory tests for measurement of dynamic soil properties, stress-strain behaviour of soil under cyclic loading.
- Ground response analysis: one-dimensional and multi-dimensional response analysis, dynamic finite element and dynamic soil-structure interaction.
- Liquefaction: evaluation of liquefaction potential and effects of liquefaction.
- Seismic stability of slopes and dams.
- Seismic design of retaining walls.

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

Contact hours: 3 lectures hour
**Text:** A set of notes will be distributed through on-line system.

**Project:** A design project will be assigned or critical review of some technical papers will be required.

**Assignments:** Assignments: problems will be assigned and the solutions will be submitted for grading by specified deadlines.

**Examination:** A 3-hour examination is held during the examination period on all work covered during the course. The examination is an Open Book, and a calculator is allowed.

**Evaluation:** The final grade is arrived at as follows:

- Project: 40%
- Assignments: 40%
- Final Examination: 20%

**Instructor:** Professor: Dr. M.H. El Naggar, P. Eng.

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**Secretary:** C. Quintus, Room EB3010

**Computing:**

Assignments will require the processing of data using computer data-analysis software such as Matlab, Excel or similar, and students will be assumed to be proficient in the use of the software of their choice.

**Units:**

SI units will be used in lectures and examinations

**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:**
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/sss/

**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.

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