

COURSE SYLLABUS**ES4423A/GP9508A Applied Seismology**Fall Term 2020, **to be offered Winter 2024****1. Course Information****Course Instructor:** Dr. Sheri Molnar

COURSE DESCRIPTION: This course provides an advanced overview of seismic hazard analysis for earthquake engineering purposes including strong motion seismology, earthquake site response and earthquake site classification techniques. Students will assess earthquake site amplification and response from empirical earthquake recordings, numerical simulations, and evaluation of case studies worldwide. Various software programs will be used to extract site characterization information and model predictions of earthquake site response.

Prerequisite(s): ES 2200, ES 2222, Calc 2303 or Calc 2503, or permission of the instructor. This course is intended for geology, geophysics, geotechnical and civil engineering senior-level undergraduate and/or graduate students with no significant prior knowledge of the course content. Contact the instructor for permission. *(Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you will be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.)*

2. Course Schedule

Course orientation

Introduction to seismic hazard analysis

Earthquake Seismology (source characteristics)

History of Earthquake Engineering, Notable damaging earthquakes

Earthquake site amplification theory

Seismic monitoring

Empirical earthquake site amplification (spectral ratios)

Earthquake site effect metrics

Earthquake site classification in Canadian seismic design code and microzonation mapping

Non-invasive Vs depth profiling methods and their application

Earthquake site response theory and numerical site response analysis

3. Course Materials

All course material will be posted to OWL: <http://owl.uwo.ca>. Students are responsible for checking OWL on a regular basis. This is the primary method by which information will be disseminated to all students in the class. If students need assistance, they can seek support on the OWL Help page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

Recommended course reading material: There is no textbook. Published literature will be provided by the instructor (through the course OWL site) as well as your own literature searches. The following publications and/or textbooks are used by the instructor in the course instruction:

- S. Kramer, 1996. *Geotechnical Earthquake Engineering*, in Civil Engineering and Engineering Mechanics, W. J. Hall (Ed.), Prentice-Hall International Series.
- S. Foti, C. G. Lai, G. Rix, and C. Strobbia, 2015. *Surface Wave Methods for Near-Surface Site Characterization*, CRC Press.
- Hunter, J.A. and Crow, H.L. (Eds.), 2015. *Shear Wave Velocity Measurement Guidelines for Canadian Seismic Site Characterization in Soil and Rock*, Earth Sciences Sector, General Information Product 110e, 226 p., <https://doi.org/10.4095/297314>

Additional recommended textbooks:

- *International Handbook of Earthquake Engineering & Seismology, Part A* (1200 p.) and *Part B* (1000 p.), Lee, Jennings, Kisslinger, Kanamori (Eds.), Elsevier.
- *Earthquake Engineering: From engineering seismology to performance-based engineering*, Y. Bozorgnia and V. V. Bertero (Eds.), 2004. CRC press.

Technical Requirements

Students, especially remote students, require a stable internet connection and computer with working microphone and camera/webcam.

4. Methods of Evaluation

The overall course grade will be calculated as listed below:

<u>ES4423 students</u>	<u>GP9508 students</u>
Assignments: 30%	Assignments: 30%
Test 1: 12.5%	Test 1: 10%
Test 2: 12.5%	Test 2: 10%
Project: 40%	Project: 40%
Participation: 5%	Presentation/Participation: 10%

Assignments: 4 assignments at 30% course grade or 7.5% each

- Assignment 1: Research a damaging earthquake and its potential site effects. Deliverables include a 'fake' website/blog with posts and oral presentation to class.
- Assignment 2: Simple harmonic motion and building oscillation. Deliverable is completed lab assignment (no formal write-up).
- Assignment 3: Theoretical site amplification and sensitivity tests, requires Matlab. Deliverable is a written formal lab report.
- Assignment 4: Time-series and frequency analysis of strong motion earthquake recordings, requires Matlab. Deliverable is a written formal lab report.

Tests will be based primarily on lecture content, written during scheduled lab sessions in BGS 0184; instructor will use Zoom to proctor remote student(s).

Project: 3 parts at 40% course grade or 13.3% each

- Part 1: Blind inversion of seismic array data, requires Geopsy.
- Part 2: Inter-method earthquake site classification and assessment, requires Excel/Matlab and Geopsy.
- Part 3: Earthquake site response analysis, requires ProShake or Deepsoil. This final course 'assignment' is due Mon. Dec. 21 2020. It should take no longer than 12 hours and the student can submit at their convenience prior to/on the Dec. 21 deadline.

Participation

Participation grade is combination of reading homework, attending lab demo, and classroom discussion. For GP9508 students, participation grade also includes oral presentation on assigned journal article(s).

Accommodated Evaluations

For missed lab assignments or project parts with accommodation (either self-reported absence or academic accommodation), the missed assessment will be waived and other assessments within the same category will be re-weighted. For a missed test with accommodation, the student will contact the instructor to determine an agreeable makeup test date.

Minimum requirements to pass the course include submission/completion of all course assessments except when approved accommodation is provided to the instructor.

5. Departmental In Person Lab Policies

COVID-19 is spread mainly from person to person through close physical contact. Close physical contact is defined as being less than 2 metres away in the same room, workspace, or area for over 15 minutes. BGS 0184 will be supplied with: paper towel, spray cleaner (for cleaning tables), large container of hand sanitizer, disinfecting wipes, soap and paper towel at sinks for handwashing.

Rules:

1. Stay home and self-isolate if you are sick
2. A UWO Ambassador will be at the beginning and end of every lab. Students will enter by swiping their ID card; Ambassador will verify they have completed the online health questionnaire and student has a face mask; if not, ambassador will provide student with face mask.
3. Everyone must wear masks (non-medical cloth mask)
4. Everyone must sanitize their hands upon arrival (supplies provided)
5. Sneeze and cough into your sleeve with your mask on
6. Avoid touching your eyes, nose or mouth. Wash or re-sanitize hands after touching face
7. Instructor will wash the desk-tops and common surfaces (door-knobs, light switches) at the start and end of each lab (supplies provided)
8. Students should wipe their equipment at the start and end of the lab (e.g. keyboards).
9. Students will sit in only the approved workspaces. All workers will be spaced 2 m apart.
10. When the instructor is helping a student, they should maintain distance as much as possible.
11. Students should not walk around the labs. The first students to enter should sit at the back of the room and at the end of the lab period the students closest to the exit should leave first.

6. Statements on Online Etiquette

Some components of this course will involve online interactions. To ensure the best experience for both you and your classmates, please honour the following rules of etiquette:

- “arrive” to class on time
- 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, mute your microphone for the entire class until you are invited to speak, unless directed otherwise
- please be prepared to turn your video camera off at the instructor’s request if the internet connection becomes unstable
- unless invited by your instructor, do not share your screen in the meeting

The course instructor will act as moderator for the class and will deal with any questions from participants. To participate please consider the following:

- If you wish to speak, either (1) turn on your video and raise your actual hand, or (2) use the “raise hand” function, and wait for the instructor to acknowledge you before beginning your comment or question.
- Please remember to unmute your microphone and turn on your video camera before speaking.
- Self-identify when speaking.
- Please 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 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” (posting insults) is never appropriate.
- Be professional and scholarly in all online postings. Use proper grammar and spelling. 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.

7. Accommodation and Accessibility

Accommodation Policies

Students with disabilities work with Accessible Education (formerly SSD) which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The Academic Accommodation for Students with Disabilities policy can be found at:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Accommodation_disabilities.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 semester, 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 policy on Academic Consideration for Student Absences - Undergraduate Students in First Entry Programs, see:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Consideration_for_absences.pdf

and for the Student Medical Certificate (SMC), see:

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:

<https://multiculturalcalendar.com/ecal/index.php?s=c-univwo>

8. Academic Policies

The website for Registrarial Services is <http://www.registrar.uwo.ca>.

In accordance with policy, <http://www.uwo.ca/its/identity/activatenonstudent.html>, the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at his/her official university address is attended to in a timely manner.

Contingency plan for an in-person class pivoting to 100% online learning

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.

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 participating in the course for their private or group study purposes. 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.

Students may use a calculator during tests (not the calculator on their cellphone).

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/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf.

Tests and examinations for remote students in this course will be conducted using Zoom. You will be required to keep your camera on for the entire session and share your screen with the invigilator if asked to do so at any time during the exam. The exam session will **not** be recorded.*

More information about the use of Zoom for exam invigilation is available in the Online Proctoring Guidelines at the following link:

<https://www.uwo.ca/univsec/pdf/onlineproctorguidelines.pdf>

Completion of this course will require you to have a reliable internet connection and a device that meets the system requirements for Zoom. Information about the system requirements are available at the following link:

<https://support.zoom.us/hc/en-us>

*Please note that Zoom servers are located outside Canada. If you would prefer to use only your first name or a nickname to login to Zoom, please provide this information to the instructor in advance of the test or examination.

9. Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on add/drop courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: <https://www.uwo.ca/sci/counselling/>

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Student Accessibility Services (SAS) at (519) 661-2147 if you have any questions regarding accommodations.

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being: <https://www.uwo.ca/se/digital/>

Learning-skills counsellors at the Student Development Centre (<http://www.sdc.uwo.ca>) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

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

Additional student-run support services are offered by the USC, <http://westernusc.ca/services>.