

## **CEE 3321A – Soil Mechanics and Hydrogeological Engineering – Course Outline 2025/26**

This is the first introductory course in the fundamentals of geotechnical engineering for students enrolled in the Department of Civil and Environmental Engineering. The students are required to attend lectures, analyse and interpret laboratory experiment results to measure the engineering properties of soil, and submit laboratory results in complete and concise reports. The general objectives are for the student to become able to:

- Understand the origin and composition of soil.
- Formulate and analysis soil volume and weight relationship and determine its density, water content and void ratio.
- Develop a comprehensive understanding of basic experiments for soil classification according to standard procedures.
- Identify soil type and classify the soil based on engineering standards.
- Analyze and examine laboratory Proctor compaction test for the determination of soil maximum density.
- Solve 1D and 2D seepage problems based on Darcy's law and graphical procedures.
- Understand the concept of effective stress and its importance in soil mechanics

### **Calendar Copy:**

Soil classification, clay mineralogy, effective stress principle, site investigation practice, soil compaction, and one and two dimensional steady state flow in natural and engineered systems.

### **Prerequisites:**

CEE 2202A/B, CEE 2224

### **Antirequisites:**

### **Corequisites:**

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:**

2 lecture hours per week; 2 laboratory hours 4 times per term (required); 2 tutorial hours 4 times per term

Submission of laboratory reports is **mandatory**

Recommended additional personal study - 3 hours/week

Lectures will be delivered in person. Lectures will be organized into learning modules which students should review on a weekly basis. Review of lecture material and self-study should take approximately 5 hours per week. Four 2-hour tutorial sessions will be delivered during the scheduled tutorial hours. Tutorials are not mandatory but students seeking assistance with assignments or clarification on lecture material are strongly encouraged to attend. 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.

**Instructor:**

Dr. Abouzar Sadrekarimi, PEng, SEB3010D,

Email: [asadrek@uwo.ca](mailto:asadrek@uwo.ca).

Office hours: by appointment

**Textbook:**

Coduto, D. P., Yeung, M R, and Kitch, W A “Geotechnical Engineering, Principles and Practices”, Prentice-Hall, Inc., 2<sup>nd</sup> edition, 2011. Hardcopy or ebook is required.

Das B.M. “Soil Mechanics Laboratory Manual” 9<sup>th</sup> Edition, Oxford University Press, 2015 (Required).

**Other References:**

**Units:**

Both SI and FPS unit systems may be used in lectures, laboratories, tutorials and examinations.

**Specific Learning Objectives:**

1. Soil Characterisation

- a) Identify basic soil groups [PA1]
- b) Draw soil grain size distribution curves based on sieve and hydrometer analyses results [PA3]
- c) Describe the basic structure and engineering properties of three clay minerals: Kaolinite, Illite, and Montmorillonite and the general physical and chemical properties of soil-water systems [KB3]
- d) Determining soil Atterberg limits (PL, LL and PI) [I2]
- e) Laboratory grain size distribution and hydrometer sedimentation [I1, I3]
- f) Carrying out laboratory Atterberg limit tests [I1, I3]

2. Soil Classification

- a) Classify soils based on the Unified Soil Classification System (USCS) [PA3]
- b) Calculate soil properties using phase relations [PA2]

3. Soil Compaction

- a) Introduction to lab compaction test [I1]

- b) Draw theoretical and experimental compaction curves [PA2]
- c) Determine the optimal water content and maximum dry density of a soil [PA3]
- d) Establish quality control criteria for field compaction works [PA1]
- e) List typical engineering applications of soil compaction [PA1]
- f) Laboratory Proctor compaction testing [I1; I3]

#### 4. Seepage and Groundwater Flow

- a) Describe the concepts of steady-state seepage and pore water pressure [PA1]
- b) Understand the nature of seepage flow in soil [PA2]
- c) Define and apply Darcy's law to calculate the steady-state groundwater flow [KB3]
- d) Define and measure hydraulic conductivity of soil and how to calculate total, pressure, and elevation heads [PA2]
- e) Understand critical hydraulic gradient and its engineering significance [PA1]
- f) Define the governing equation for 2D steady-state seepage flow in soil and solve the equation using the flow-net. Draw flow nets for engineering applications, including (1) calculate the seepage flow in isotropic and anisotropic soils, (2) calculate the pore water pressure in soil and (3) calculate the uplifting force due to seepage [PA3].

The instructor may expand, or revise material presented in the course as appropriate.

#### **General Learning Objectives:**

E=Evaluate, T=Teach, I=Introduce; (Introductory, Developing or Advanced level)

Knowledge Base	E (D)	Engineering Tools		Impact on Society	
Problem Analysis	E (D)	Team Work		Ethics and Equity	
Investigation	E (D)	Communication		Economics and Project Management	
Design		Professionalism		Life-Long Learning	

#### **Accreditation Units:**

Engineering Science = 60%; Engineering design = 40%

#### **Evaluation:**

The final course mark will be determined as follows:

Lab reports:	20%
Mid-term exam:	25%
Participation:	5%
Final exam:	50%
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Total	100%

Note:

- a) **Students must pass the final examination to pass this course.** Students who fail the final examination will be assigned the aggregate mark, as determined above, or 48%, whichever is less.

- b) **Students must turn in all laboratory reports, and achieve a passing grade in the laboratory component, to pass this course.** Students who do not satisfy this requirement will be assigned 48% or the aggregate mark, whichever is less.
- c) **Attending the laboratory sessions is mandatory.** Students should attend all laboratory sessions and failure to do so will result in a mark of zero for that laboratory session.
- d) **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 laboratory, assignment or test marks from previous years. Previously completed assignments and laboratories cannot be resubmitted.
- e) Should any of the exams conflict with a religious holiday that a student wishes to observe, the student must inform the instructor of the conflict no later than two weeks before the scheduled test. (For further information on Accommodations for Religious Holidays see [http://www.uwo.ca/univsec/handbook/appeals/accommodation\\_religious.pdf](http://www.uwo.ca/univsec/handbook/appeals/accommodation_religious.pdf))

#### Lab reports:

A report for each laboratory session should be submitted by the due date specified by the instructor or the TA. The report will be prepared as a group and all group members should participate in developing the laboratory report. The report shall include a description of the test conducted, objectives, testing method, results, and conclusions. Laboratory groups will be assigned by the instructor at the beginning of the semester. Late submissions will be deducted 10% per day and not accepted after 7 days of delays.

#### Midterm Exam

A 60-minute mid-term exam will be tentatively held during the lecture period on Monday, November 10<sup>th</sup> from 2:40 to 3:40 pm. The exam will cover material from the first 2 months of class and will be closed book.

**Academic consideration will not be given for this assessment without appropriate documentation.**

#### Participation:

Participation will be assessed based on class attendance, participation in lectures and tutorials and completion of short in-class assessments.

#### Final Exam

The final examination will be 3 hours, held during the examination period of the fall term. In addition to the material covered in the class lectures, the exams may include questions from the laboratory portion of the class. When needed, neatly draw all sketches and data plots using a straight edge, French curve, compass, etc., and show all relevant labels. When feasible, site plans and schematics should be drawn to a proportional scale. Failure to submit legible, neat, professional looking solutions will adversely affect your exam mark.

### **Policy Framework: Missed Classes, Late Work, and Academic Integrity**

#### **Absence/Late Accommodation Policy**

1. Students must familiarize themselves with the University Policy on Academic Consideration –

Undergraduate Students in First Entry Programs posted on the Academic Calendar:

[https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/academic\\_consideration\\_Sep24.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration_Sep24.pdf)

This policy does not apply to requests for Academic Consideration submitted for attempted or completed work, whether online or in person. The policy also does not apply to students experiencing longer-term impacts on their academic responsibilities. These students should consult [Accessible Education](#).

2. Students missing a test/assignment/lab or examination will report the absence by submitting Academic Consideration Request form through [STUDENT ABSENCE PORTAL](#).
3. All requests for Academic Considerations must be made within **48 hours** after the assessment date or submission deadline. All Academic Consideration requests must include supporting documentation. However, recognizing that formal documentation may not be available in some extenuating circumstances, the policy allows students to make one Academic Consideration request without supporting documentation in this course. However, the following assessments are excluded from this, and therefore always require formal supporting documentation:
  - Examinations scheduled during official examination periods.
  - Midterm Tests and other designated assessments as noted on the course outline.
  - Any assessment already covered by a flexible deadline.
  - If a student mistakenly submits their one allowed Academic Consideration request without supporting documentation for the assessments listed above that do not require academic consideration, the request cannot be recalled and reapplied. This privilege is forfeited.
4. Requests without supporting documentation are limited to one per term per course.
5. **An undocumented absence is only valid for a 24-hour period, from midnight on the day specified to midnight of the following day.** An appropriate use of an undocumented absence would be for an in-class assessment that takes place that day. Where the time given to complete the assessment is longer than 24 hours, an undocumented absence will not cover a student for the full time given to complete the assessment, and flexibility considerations in submitting the assessment will override the undocumented absence.
7. NOTE: Forged notes and certificates will be dealt with severely. To submit a forged document is a scholastic offence.
8. It is the student's responsibility to check the date, time and location of the [Special Examination](#).

## II. Religious Accommodation

When scheduling unavoidably conflicts with religious holidays, which (a) require an absence from the University or (b) prohibit or require certain activities (i.e., activities that would make it impossible for the student to satisfy the academic requirements scheduled on the day(s) involved), no student will be penalized for absence because of religious reasons, and alternative means will be sought for satisfying the academic requirements

involved. If a suitable arrangement cannot be worked out between the student and instructor involved, they should consult the appropriate Department Chair and, if necessary, the student's Dean.

It is the responsibility of such students to inform themselves concerning the work done in classes from which they are absent and to take appropriate action.

### III. **Academic Integrity**

In the Faculty of Engineering, we encourage students to create a culture of honesty, trust, fairness, respect, responsibility, and courage, befitting the professional degree you are pursuing.

Please visit [Academic Integrity Western Engineering](#) for more information

### IV. **Academic Offences**

Plagiarism means using another's work without giving credit. The university has rules against plagiarism and other scholastic offences. Western Engineering has a zero-tolerance policy on plagiarism. The minimum penalty is zero on the course work and a repeat offence will earn you zero on the course. A third offence may lead to expulsion from the university.

[Scholastic Discipline for Undergraduate Students & Cheating, Plagiarism and Unauthorized Collaboration: What Students Need to Know](#)

Students must write their reports, essays and assignments in their own words. Whenever students take an idea or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. University policy states that cheating, including plagiarism, is a scholastic offence. The commission of a scholastic offence is attended by academic penalties, which might include expulsion from the program. If you are caught cheating, there will be no second warning.

All required papers may be subject to submission for textual similarity review to commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted will be included as source documents on 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>). Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, in the relevant section of the Academic Handbook:

[http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/scholastic\\_discipline\\_undergrad.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf)

### V. **Faculty of Engineering AI Policy**

The use of generative Artificial intelligence (GenAI) tools won't be discouraged in the Faculty of Engineering. As we pride ourselves on building the future we can't hide from

the use of GenAI tools to contribute to the understanding of the course materials. You are able to use GenAI tools as follows:

- For any written assignment, except take-home exams and personal reflections, you may use a GenAI tool to help you brainstorm or frame your initial ideas and grammar. However, your final submission must be entirely in your own words and demonstrate your individual experience and insight.
- For any written or practical project AI tools may be used across your workflow. Use them responsibly and reflect in your final presentation on how these tools supported or challenged your creative thinking.
- All GenAI tools used at any point of the course with the intent of helping with homework, assignments or any other assessment content must be disclosed and referenced appropriately.

**GenAI tools use won't be permitted in any type of examination or other assessments where the faculty have prohibited their use.** If use of GenAI tools is detected by the instructor in these instances, academic offences penalties might be imposed against the student.

## VI. **Accessibility**

Western is committed to achieving barrier free accessibility for persons with disabilities studying, visiting and working at Western. As part of this commitment, there are a variety of services, groups and committees on campus devoted to promoting accessibility and to ensuring that individuals have equitable access to services and facilities. To help provide the best experience to all members of the campus community, please visit the [Accessibility Western University](#) for information on accessibility-related resources available at Western.

Students with disabilities may arrange for academic accommodation at Western. For a more detailed explanation, please visit [Academic Support & Engagement -Academic Accommodation](#).

## VII. **Inclusivity, Diversity, and Respect**

The Faculty of Engineering at Western University is committed to creating equitable and inclusive learning environments that value diverse perspectives and experiences. We recognize that university courses often marginalize students based on social identity characteristics such as, but not limited to, Indigeneity, race, ethnicity, nationality, ability, gender identity, gender expression, sexuality, age, language, religion, and socioeconomic status. Understanding this, we strive to facilitate equitable experiences and inclusion within the classroom by respecting and integrating multiple ways of knowing, being, and doing. Please visit the [Office of Equity, Diversity and Inclusion](#).

## VIII. **Health and Well-Being**

- [Health & Wellness Services – Students](#) - Offers appointment-based medical clinic for all registered part-time and full-time students.
- [Mental Health Support](#) - Provides professional and confidential services, free of charge, to students needing assistance to meet their personal, social and academic goals. Services include consultation, referral, groups and workshops, as well as brief, change-oriented psychotherapy.
- [Crisis Support](#) - For immediate assistance, please visit Thames Hall Room 2170 or call 519-661-3030. The crisis clinic operates between 11:00 am - 4:30 pm. For after-hours crisis support, click [here](#).
- [Gender-Based Violence and Survivor Support](#) - “Western is committed to reducing incidents of gender-based and sexual violence (GBSV) and providing compassionate support to anyone who is going through or has gone through these traumatic events. If you are experiencing or have experienced GBSV (either recently or in the past), you will find information about support services for survivors, including emergency contacts at the following website:  
[https://www.uwo.ca/health/student\\_support/survivor\\_support/gethelp.html](https://www.uwo.ca/health/student_support/survivor_support/gethelp.html) To connect with a case manager or set up an appointment, please contact [support@uwo.ca](mailto:support@uwo.ca).

### **Important Contacts**

<a href="#">Engineering Undergraduate Services</a>	SEB 2097	519-661-2130	<a href="mailto:engugrad@uwo.ca">engugrad@uwo.ca</a>
<a href="#">Office of the Registrar/Student Central</a>	WSSB 1120	519-661-2100	

### **Important Links**

- [WESTERN ACADEMIC CALENDAR](#)
- [ACADEMIC RIGHTS AND RESPONSIBILITIES](#)
- [ENGINEERING PROGRESSION REQUIREMENTS AND ACADEMIC REGULATIONS](#)
- [UNIVERSITY STUDENTS' COUNCIL \(USC\) - SERVICES](#)
- [IMPORTANT DATES AND DEADLINES](#)
- [ACADEMIC CONSIDERATION FOR MEDICAL ILLNESS - UNDERGRADUATE STUDENTS](#)
- [ACCOMMODATIONS FOR RELIGIOUS HOLIDAYS](#)
- [SCHEDULING OF ASSIGNMENTS, TESTS, AND EXAMINATIONS](#)



- [STUDENT FORMS](#)
- [OFFICE OF THE REGISTRAR](#)
- [RETENTION OF ELECTRONIC VERSION OF COURSE OUTLINES \(SYLLABI\)](#)
- [ACADEMIC APPEALS](#)
- [STUDENT ABSENCE PORTAL](#)