# CIVE 4208: Geotechnical Engineering, Course Syllabus - Fall 2023

Faculty of Engineering and Design, Carleton University
Department of Civil and Environmental Engineering

| Sections **A** | Time: **Tuesdays 2:35-5:25 PM** | Location: check Public Class Schedule |
|---|---|---|

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## 1 Course Overview:

In this course, we explore the application of soil mechanics concepts (obtained in CIVE 3208) to analysis and design of geotechnical systems such as foundations, slopes, embankments, and retaining walls. The course also includes training and assignments using GeoStudio simulation software.

## 2 Student Learning Outcomes:

At the end of this course, students will be able to:

- Calculate shear strength of different types of soils under various loading conditions.
- Analyze stability of slopes using common methods and computer simulations.
- Analyze water flow in geotechnical structures and its effect on stability.
- Calculate lateral pressure of soil.
- Analyze stresses applied to rigid and flexible earth retaining walls
- Understand and apply common criteria in design of earth retaining walls.
- Calculate the bearing capacity of shallow foundations in different soils, and design for different load conditions.

## 3 Textbook:

The course textbook is the following: **Soil Mechanics and Foundations (3rd Edition)**, by M. Budhu

Other useful sources: **Craig's Soil Mechanics, (7th Edition)**, by R.F. Craig.

## 4 Tentative Lecture Schedule:

**Table 1. Lectures Content**

| Lec no.* | Topic | Book Chapter† |
|---|---|---|
| 1-3 | Shear Strength of Soils | 7, 8, 10 |
| 4-6 | Slope Stability | 16 |
| 7-8 | GeoStudio Training‡ | - |
| 9-12 | 2D Flow of Water through soils | 14 |
| 13 | GeoStudio Training | - |
| 14-16 | Lateral Earth Pressure | 15 |
| 17-20 | Design of Soil Retaining Structures | 15 |
| 21-23 | Shallow Foundations | 12 |
| 24 | Review & Problem Solving | - |

* Each **1.5 hr** is counted as **one** lecture. A 3hrs lecture is counted as two.
† Chapters from: Soil Mechanics and Foundations (3rd Edition), by M. Budhu.
‡ Lecture 7-8 on GeoStudio Software training will be asynchronous and online. The software is available on Department's virtual computers. A student version can be installed on Windows PC's.

## 5 Prerequisites knowledge (**Important**)

This course builds on the **basic understanding of geotechnical mechanics** (CIVE 3208) and solid mechanics (CIVE 2200) as delivered at Carleton University. Most relevant topics from CIVE 3208 include **phase relations, stresses in soil, geotechnical tests (triaxial and direct shear), Shear strength of soils, and seepage**. We will also use the concept of **Mohr circle** from CIVE 2200 and CIVE 3208. Use the textbook (by M. Budhu) to refresh or acquire the basis knowledge that we will build upon. In particular, make sure you review these chapters: Chapter 4 (phase relations), Chapter 6 (1D flow of water in soil), Chapter 7 (Effective stress, Mohr circle), Chapter 10 (Shear strength, Mohr-Coulomb failure, triaxial test, Pore pressure).

## 6 Mode of delivery

All the exams and lectures will be **in-person**, except for lecture 7-8 (**Oct 3rd**) which will be asynchronous online to allow for a better software training. The videos for lecture 7-8 will be posted at the beginning of the week.

## 7 Assessment:

Breakdown of the final grade is given in **Table.2**. A minimum of **35%** in each component is required to obtain a passing grade. Attendance in lectures is not mandatory. Exams will be in-person.

**Table 2. Assessment Breakdown**

| # | sections | Description | Weights |
|---|---|---|---|
| 1 | Assignments | Bi-Weekly assignments (4~5 Assignments) | 15% |
| 3 | Midterm Exam | 2 hours, closed-book, formula sheet provided*, (tentative date: Nov 4th). | 35% |
| 4 | Final Exam* | 2~3 hours, closed-book, formula sheet provided*. Date and time TBD. | 50% |

*Final exams are for evaluation purpose and will not be returned to students.

### 7.1 Late Submission Policy for Assignments:

Assignments submitted after the deadline, and up to one day late, will receive a penalty of 10% of the full grade. Work submitted after this time, and up to three days late, will receive a penalty of 25% of the full grade. Work that is more than three days late will not be graded. A student may request an extension, stating the reason in writing at least one day before the deadline. An extension may be granted at the discretion of the instructor.

### 7.2 Deferred term work

Students who claim illness, injury or other extraordinary circumstances beyond their control as a reason for missed term work (including midterm exam) are held responsible for immediately informing the instructor concerned and for making alternate arrangements with the instructor and in all cases. This must occur no later than **three (3) days after the term work was due**. In case of illness, a doctor note or a completed self-declaration form will be required (https://carleton.ca/registrar/special-requests/deferral/). The alternate arrangement must be made before the last day of classes in the term as published in the academic schedule. Consult Section 4.4 of the University Calendar.

# 8 Course Policies (**Important**)

## 8.1 Classroom Behaviour:

Students are required to observe standards of behaviour expected in a university environment and in the profession of engineering. Please maintain a professional, quiet, attentive, and engaging classroom environment.

## 8.2 Communications:

Course materials will be distributed through the course's **BrightSpace** page. Students are responsible for ensuring they are correctly registered through **BrightSpace**, and for checking the **BrightSpace** course management site regularly. Lecture slides will be made available before class; however, lecture slides will not include all the information discussed during the (e.g. solutions, calculations, and extra clarifications).

**Important Note:** All electronic communications with the instructor must be through official **Carleton email accounts**. In your email, include your **full name, student number, course, and section number**. Professionalism is expected in all course communications; e-mails with **improper language will not receive a response**. Electronic correspondence should be limited to the scheduling of meetings or providing information (e.g. absence from an exam). **Course material cannot be clarified through e-mail**.

## 8.3 Attendance and Absences:

Attendance is not mandatory for lectures. However, attendance in examinations is mandatory and you will lose the designated mark for the exams that you have miss.

## 8.4 Appeals:

All grade appeals in this course must be made within seven days of the posting or return of the graded component. Appeals for assignments are to be addressed to the marking TA first. The final exam is for evaluation purposes only, and the paper will not be returned or made available to students by the instructors after it is marked. You will be able to make arrangements with the instructor or with the department office to see your marked final examination after the grades have been made available.

# 9 Copyright on Materials (**Important**)

The materials created for this course (including the course outline and any slides, posted notes, labs, project, assignments, exams and solutions) are intended for personal use and should not be reproduced, redistributed, or posted on any **website** without prior written permission from the author(s).

## Other relevant information and policies

- **Academic Integrity and Plagiarism:**

a) Please consult the Faculty of Engineering and Design information page about the Academic Integrity policy and our procedures: https://carleton.ca/engineering-design/current-students/fed-academic-integrity Violations of the Academic Integrity Policy will result in the assignment of a penalty such as reduced grades, the assignment of an F in a course, a suspension or, expulsion.

b) One of the main objectives of the Academic Integrity Policy is to ensure that **the work you submit is your own.** As a result, it is important to write your own solutions when studying and preparing with other students and to avoid plagiarism in your submissions. The University Academic Integrity Policy defines plagiarism as "presenting, whether intentionally or not, the ideas, expression of ideas or work of others as one's own." This includes reproducing or paraphrasing portions of someone else's published or unpublished material, regardless of the source, and presenting these as one's own without proper citation or reference to the original source.

Examples of violations of the policy include, but are not limited to:

- any submission prepared in whole or in part, by someone else;
- using another's data or research findings without appropriate acknowledgement;
- submitting a computer program developed in whole or in part by someone else, with or without modifications, as one's own; and
- failing to acknowledge sources of information through the use of proper citations when using another's work and/or failing to use quotations marks.

- **Learning and Working Environment**

The University and all members of the University community share responsibility for ensuring that the University's educational, work and living environments are free from discrimination and harassment. Should you have concerns about harassment or discrimination relating to your age, ancestry, citizenship, colour, creed (religion), disability, ethnic origin, family status, gender expression, gender identity, marital status, place of origin, race, sex (including pregnancy), or sexual orientation, please contact the Department of Equity and Inclusive Communities at equity@carleton.ca
We will strive to create an environment of mutual respect for all through equity, diversity, and inclusion within this course. The space which we work in will be safe for everyone. Please be considerate of everyone's personal beliefs, choices, and opinions.

- **Academic Accommodations**

You may need special arrangements to meet your academic obligations during the term. For an accommodation request the processes are as follows:

**Academic Accommodations for Students with Disabilities**: The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at **613-520-6608** or pmc@carleton.ca .
You should request your academic accommodations in the Ventus Student Portal, for each course at the beginning of every term. For in-term tests or midterms, please request accommodations at least

two (2) weeks before the first test or midterm. Please consult the PMC website for the deadline to request accommodations for the formally-scheduled exam (if applicable).

**Accommodation for Student Activities**: Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, see the Senate Policy on Accommodation for Student Activities (PDF).

**Pregnancy Obligation**: Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, please review the Student Guide to Academic Accommodation (PDF).

**Religious Obligation**: Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, please review the Student Guide to Academic Accommodation (PDF).

**Survivors of Sexual Violence**: As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and where survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit the Sexual Violence Prevention & Survivor Support.

- **Engineering Academic Advising**

The Engineering Academic Support Service assists undergraduate engineering students with course selection, registration, and learning support from first-year through to graduation.
Academic Advisors Contact can be found here: https://carleton.ca/engineering-design/current-students/undergrad-academic-support/undergraduate-advisors/.

## Useful FYIs:

Note: The Graduate Attributes and Accreditation Units described below **have no impact** on individual student evaluation in the course.

- **Graduate Attributes:**

The Canadian Engineering Accreditation Board (CEAB) requires graduates of undergraduate engineering programs to possess 12 attributes. Courses in all four years of our programs evaluate students' progress towards acquiring these attributes. Aggregate data (typically, the data collected in all sections of a course during an academic year) is used for accreditation purposes and to guide improvements to our programs. Some of the assessments used to measure GAs may also contribute to final grades; however, the GA measurements for individual students are not used to determine the student's year-to-year progression through the program or eligibility to graduate. This following list provides the GAs that will be measured in this course, along with the Learning Outcomes that are intended to develop abilities related to these attributes.

GAs measured in CIVE4208 include: 1.6.C (Discipline-specific concept CEE-6 Geotechnical Engineering), 2.1 (Problem definition), 2.2 (Approach to the problem), 2.3 (Use of assumptions), and 2.4 (Interpreting the solution – validity of results). GA scores in this course are measured based on assignments and exams.

For information on GAs and continual curriculum improvement, visit the Accreditation section of Engineers Canada website.

- **Accreditation Units**

| Math | Natural Science | Complementary Studies | Engineering Science | Engineering Design |
|---|---|---|---|---|
| - | - | - | 50% | 50% |