CIV ENG 3B03
Geotechnical Engineering II
Course Outline

1. COURSE INFORMATION

Session Offered	Winter 2026
Course Name	Geotechnical Engineering II
Course Code	CIV ENG 3B03
Date(s) and Time(s) of lectures	Lectures - Tue, HH 302, 8:30-10:20am Tutorials - T01 Tue, BSB 121, 10:30-12:20pm; T02 Thu, JHE 326H, 11:30-1:20pm. Labs - L01 Thu, JHE 114, 2:30-5:20pm; L02 Mon, JHE 114, 2:30-5:20pm. LAB dates arranged by LAB Group - schedule on Avenue
Program Name	Civil Engineering
Calendar Description	Shear strength characteristics and failure criteria for soils; direct shear, triaxial, plane strain and field tests; earth pressure theory; bearing capacity theory; slope stability and embankment analysis.
Instructor(s)	Mahyar Malekzade Kebria, Ph.D. E-Mail: malekm9@mcmaster.ca Office Hours & Location: by appointment only
TAs	Taia Mussari mussarit@mcmaster.ca Masih Andalib andalibm@mcmaster.ca Hanzhang Lu lu344@mcmaster.ca

2. COURSE SPECIFICS

Course Description	This course builds on the basic concepts of soil mechanics introduced in the prerequisite course, CIV ENG 3A03, and begins to apply these concepts to geotechnical and foundation engineering. The basic concept of soil strength is explored in greater detail through lab tests, and with this greater insight students are presented with basic methodologies for the design of shallow foundations, the analysis of the stability of slopes, and the design and analysis of earth retaining structures.		
Resources	**ISBN**	**Textbook Title & Edition**	**Author & Publisher**
	ISBN: 978-0-470-55684-9	**Soil Mechanics and Foundations, 3rd Edition**	**Budhu, John Wiley & Sons**
	Other Supplies	**Source**	
	Labs Notes	*To be distributed during the labs and posted on A2L*	
Prerequisite(s)	*CIV ENG 3A03*		
Corequisite(s)	*None*		
Antirequisite(s)	*None*		
Course Specific Policies	WHIMIS Training for Laboratory Sessions Students MUST complete all 4 of the required Laboratory Sessions. **Students who miss an assigned Lab will be reassigned to perform the Lab on an alternate date and time.** The Labs will be completed as Groups but each student is responsible for submitting an individual Lab Report. It is strongly recommended that students record their own data during the Lab.		

	Only McMaster approved calculators will be permitted during the Midterm and the Final Exam. No additional 'aids' will be permitted during these Exams.

3. SUB TOPIC(S)

(Note: A more detailed week-by-week schedule will be posted on A2L)

Mechanical Characteristics of Soils

- Brief review of phase relationships, soil classification, soils investigations, effective stress, stresses and displacements from elastic theory, and consolidation of fine-grained soils (Chapters 2, 3, 4,and 7)
- General state of stress, principal stresses, Mohr's circle representation, the Mohr-Coulomb failure criterion, stress-path, q, p invariants, direct shear test, triaxial tests (drained and undrained behaviour), and liquefaction (Chapters 7, 10)

Applications of Shear Strength Theory to Geotechnical Engineering

- Bearing capacity theory: Allowable stress and Load and Resistance Factor Design, limit equilibrium method, bearing capacity equations, immediate and primary consolidation settlement, capacity from field tests (Chapter 12)
- Earth retaining structures: Active and passive earth pressure, earth pressure at rest, Coulomb and Rankin methods, rigid and flexible retaining walls, braced excavations, and mechanically stabilized earth walls (Chapter 15)
- Slope stability: types and causes of slope failures, 2D slope stability analysis, rotational slope failure, and method of slices (Chapter 16)

Mid-term recess – February 20 to 26

Classes end – Wednesday, April 12, 2023

Final examination period: Friday, April 14, to Saturday, April 29, 2023

All examinations MUST BE written during the scheduled examination period.

List of Labs

Lab 1	Direct Shear Test on sand
Lab 2	Vacuum Triaxial Test on sand
Lab 3	Unconfined Triaxial Compression on clay
Lab 4	Unconsolidated Undrained Triaxial Compression on clay

Note that this structure represents a plan and is subject to adjustment term by term.
The instructor and the University reserve the right to modify elements of the course during the term. The University may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes.

4. ASSESSMENT OF LEARNING *including dates*	Weight
Assignments (3)	15%
Group Assignment (1)	10%
Labs (4)	20%
Term Test	20%
Final examination (tests cumulative knowledge)	35%
TOTAL	**100%**

Percentage grades will be converted to letter grades and grade points per the University calendar.
NOTE: You must have a combined passing grade on the Term Test and Final Exam to pass the course.

5. LEARNING OUTCOMES	CEAB GA
1. Demonstrate a working knowledge of basic soil mechanics principles including: phase relationships, soil descriptions and classifications, and effective stress	1.4
2. Understand the results of typical lab tests used to evaluate the shear strength of soil, including the direct shear test and the vacuum triaxial test, the unconfined compression test, and the unconsolidated-undrained triaxial test	1.4

3. Demonstrate an understanding of principal stresses, stress invariants, Mohr's circle, and the Mohr-Coulomb failure criteria as it relates to soils	1.4, 2.2
4. Understand how to calculate the bearing capacity and settlement (immediate and primary consolidation) of shallow foundations	2.2, 2.3
5. Understand both the allowable-stress and the Load Resistance Factor Design process for shallow foundations	4.1, 4.2
6. Understand how to apply the results from common field tests to the design of shallow foundations and earth retaining structures	4.1, 4.2
7. Understand the concept of active and passive earth pressure and be able to apply it to the analysis and design of earth retaining structures	2.3, 4.2
8. Understand how to calculate the stability of an embankment	2.3

6. COURSE OUTLINE – APPROVED ADVISORY STATEMENTS

ANTI-DISCRIMINATION

The Faculty of Engineering is concerned with ensuring an environment that is free of all discrimination. If there is a problem, individuals are reminded that they should contact the Department Chair, the Sexual Harassment Officer or the Human Rights Consultant, as soon as possible.
http://www.mcmaster.ca/policy/General/HR/Discrimination_Harassment_Sexual_Harassment-Prevention&Response.pdf

ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. It is your responsibility to understand what constitutes academic dishonesty.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/

The following illustrates only three forms of academic dishonesty: The following illustrates only three forms of academic dishonesty:

- plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
- improper collaboration in group work.
- copying or using unauthorized aids in tests and examinations.

AUTHENTICITY / PLAGIARISM DETECTION

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. A2L, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, other software, etc.). For more details about McMaster's use of Turnitin.com, please go to www.mcmaster.ca/academicintegrity.

COURSES WITH AN ON-LINE ELEMENT

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn (A2L), LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in a course that uses

on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor.

ONLINE PROCTORING

Some courses may use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

COMMUNICATIONS

It is the student's responsibility to:

- Maintain current contact information with the University, including address, phone numbers, and emergency contact information.
- Use the University provided e-mail address or maintain a valid forwarding e-mail address.
- Regularly check the official University communications channels. Official University communications are considered received if sent by postal mail, by fax, or by e-mail to the student's designated primary e-mail account via their @mcmaster.ca alias.
- Accept that forwarded e-mails may be lost and that e-mail is considered received if sent via the student's @mcmaster.ca alias.
- Check the McMaster/Avenue email and course websites on a regular basis during the term.

CONDUCT EXPECTATIONS

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the Code of Student Rights & Responsibilities (the "Code"). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, whether in person or online.

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students' access to these platforms.

ACADEMIC ACCOMMODATION OF STUDENTS WITH DISABILITIES

Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) at 905-525-9140 ext. 28652 or sas@mcmaster.ca to make arrangements with a Program Coordinator. For further information, consult McMaster University's Academic Accommodation of Students with Disabilities policy.

REQUESTS FOR RELIEF FOR MISSED ACADEMIC TERM WORK

McMaster Student Absence Form (MSAF): In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar "Requests for Relief for Missed Academic Term Work".

ACADEMIC ACCOMMODATION FOR RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVANCES (RISO)

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students should submit their request to their Faculty Office normally within 10 working days of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.
http://www.mcmaster.ca/policy/Students-AcademicStudies/Studentcode.pdf

COPYRIGHT AND RECORDING

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, including lectures by University instructors
The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

EXTREME CIRCUMSTANCES

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.