University of Manitoba	Fall XXXX
Department of Civil Engineering	CIVL 3730

Course identification	
Course name:	Geotechnical Materials and Analysis
Prerequisites:	CIVL 2770, CIVL 2800, GEOL 2250
Lecture hours:	12:30 – 13:20 PM MWF
Tutorial hours:	10:00 – 11:20 AM Tuesday - the same schedule with Laboratory

Instructor	
Instructor:	Marolo C. Alfaro, PEng, PhD
Contact information:	Room E1-368, Phone: (204) 474-8155, alfarom@cc.umanitoba.ca
Office hours:	9:00 - 10:30 AM MWF

Teaching Assistants	
Teaching Assistant(s):	David Flynn, EIT, MSc Student ; Earl Marvin de Guzman, MSc Student
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Office hours:	TBA

Course description and learning outcomes

Background

This course follows directly from CIVL 2770 Civil Engineering Materials, CIVL 2800 Solid Mechanics, and GEOL 2250 Geology for Engineers. It is an extension of what is often called Soil Mechanics in other institutions but it also contains a component that forms an introduction to Rock Mechanics. The course is a pre-requisite for CIVL 4220 Geotechnical Design and CIVL 4230 Geotechnical Engineering.

General Objective

To introduce students to the properties of geotechnical materials used in civil engineering construction, and the analyses that are commonly used for displacement and stability calculations of typical geotechnical problems.

Learning Outcomes

The student should be able to:

1) determine the engineering properties of geotechnical materials using laboratory tests.
2) recognize the limitations by which properties are assessed.
3) understand the principles of soil and rock mechanics.
4) apply the derived material properties for use in the analysis and design of simple earth-support systems, slopes, shallow foundations, and deep foundations.
5) use common analytical and numerical tools in the analysis and design of simple earth-support systems, slopes, shallow foundations, and deep foundations.

Course web site

Your Jump Portal Server

Textbook

Required Textbook
(1) Budhu, M., Soil Mechanics and Foundations (3rd Edition), John Wiley and Sons, 2010.

References
(1) Craig, R.F., Soil Mechanics (6th Edition), Chapman and Hall, 1997.
(2) Al-Khafaji, A.W. and Andersland, O.B., Geotechnical Engineering and Soil Testing, Saunders, 1992.
(3) Hudson, J.A and Harrison, J.P., Engineering Rock Mechanics, Pergamon, 1997.

Assignments/projects/lab reports

Numerical problems will be assigned regularly. They have to be submitted on the indicated due date. Late assignments will be assessed a 10% reduction per day late to a maximum of 50% at 5 days late (including weekends and holidays) after which a mark of zero will be recorded. Solutions will be provided after the assignments are marked.

Laboratory tests will be done in the Geotechnical Laboratory located in E1-117. The laboratory project consists of laboratory testing, recording, data analysis, and reporting. Grade contribution of Laboratory Reports is 10% of the total grade.

Tutorial sessions are meant to illustrate and reinforce the lectures. Solutions to the problems and hands-on sessions for the use of computer software in Geotechnical Analysis will be done during tutorials.

Term tests

Tuesday, 16 October 2012, 10:00 - 11:30 AM, Room E2-125. Closed book exam. Formulas provided.

Final exam

To be arranged by Student Records Office. Closed book exam. Formulas provided.

Assessment method

There are three components of this course: lectures, tutorial sessions, and laboratory sessions. Three one-hour lectures (MWF) will be given each week. There will be a 1.5-hour midterm examination contributing 30% of the final grade, and a three-hour final examination contributing 50%. If for legitimate reason you miss the midterm exam, the weight of that exam will be added to the weight of the final exam. Students are required to achieve a passing grade in the individual, supervised assessment component of the course (combination of midterm and final exams).

You are required to attend tutorials on Tuesday mornings. The tutorial sessions are done to reinforce the lectures (that is, they concentrate on solutions to problems) and additional explanation. Tutorial sessions also involve the use of commercially available computer software for stress and deformation calculations and stability analysis of soil and rock structures. Numerical problems will be assigned regularly. They have to be submitted about one week after being assigned. Numerical problems will be assigned regularly. Submission of all Assignments will contribute 10% of the final grade. Solutions will be provided after the assignments are marked.

You are also required to undertake laboratory projects to introduce you to the laboratory techniques to determine the engineering properties of soils and rocks. It is important for you to know what is involved and how reliable these procedures are when the properties coming from the laboratory are used in the analysis and design of foundations and earth structures. Submission of all Laboratory Reports will contribute to 10% of the final grade.

Please understand the importance of conscientiously completing assignments and laboratory reports as an aid to understanding the course work and preparing for the examinations.

Policies

The Faculty of Engineering expects regular attendance of all students at lectures, tutorials and laboratories (Faculty of Engineering, Section 4.12, of The University of Manitoba General Calendar). Attendance will be taken during lectures and tutorials. If the number of unexcused absences of a student exceeds 10%, that student may be barred from writing the final exam. Valid absences should be reported to the instructor.

The undergraduate calendar defines plagiarism as taking ideas or words of another person and passing them off as one's own. In short, it is stealing something intangible rather than an object. It will be considered plagiarism and/or cheating if you copy the answers of another student in any examination or take-home assignment. Plagiarism or any other form of cheating in tests, examinations or take-home assignments is subject to severe academic penalty (e.g. suspension or expulsion). A student found guilty of contributing to cheating is also subject to serious academic penalties.

Course notes are the *intellectual property of the instructor*. These notes cannot be copied, distributed, shared, or posted on any websites without a written permission of the instructor.

Additional information

Please check your Jump Portal Server for periodic announcements and updates.

Teaching assistants are available for consultation only during their office hours. Appointments outside their office hours may be arranged with them under special circumstances. Teaching assistants will arrange later their office hours and locations. Students should not be consulting teaching assistants in their office to avoid disruption to other graduate students who share office space.

Detailed course content

	Course Content	*Estimated Lecture Hours*	*Textbook Reference*
0	Introduction	1 hour	Chapter 1
	0.1 Course outline and administration		
	0.2 Marvels of Civil Engineering		
	0.3 Lessons from Failures		
1	Basic Soil Properties	5 hours	Chapter 2 and Chapter 4
	1.1 Physical properties		
	1.2 Phase relationships		
	1.3 Particle size analysis		
	1.4 Soil classification		
	1.5 Soil compaction		
	1.6 Seasonal frost heave		
2	Stresses in Soils and Rocks	9 hours	Chapters 7-8 + Handouts
	2.1 Geotechnical material behaviour		
	2.2 State of stresses		
	2.3 Effective stress principle		
	2.4 Stresses from surface loads		
	2.5 Stress-strain invariants and stress paths		
	2.6 Rock mechanics		
3	Consolidation Analysis of Soils	8 hours	Chapter 9
	3.1 Consolidation in fine-grained soils		
	3.2 Calculation of primary consolidation settlement		
	3.3 Determination of consolidation parameters		
	3.4 1-D consolidation theory		
	3.5 Preconsolidation of soils with wick drains		
4	Strength and Deformation of Soils	10 hours	Chapters 10-11
	4.1 Tests for soil strength		
	4.2 Typical response of soils to shearing forces		
	4.3 Mohr-Coulomb failure criterion		
	4.4 Undrained and drained shear strength		
	4.5 CD-CU triaxial stress paths		
	4.6 Critical state soil mechanics		
	4.7 Prediction of soil behaviour		
5	Slope Stability Analysis	4 hours	Chapter 16
	5.1 Slope failures and analysis		
	5.2 Analysis of rotational failures		
	5.3 Analysis of translational failures		
	5.4 Slope/W computer software		
	5.5 Methods of slope stabilization		
		Total 37 hours	

Note: The remaining Chapters and Topics of the textbook will be taken in the corresponding Courses

Chapter	*Topic*	*Course*
3	Soils Investigation	CIVL 4220
6	1-D Flow of Water Through Soils	CIVL 4250
12	Bearing Capacity and Settlement of Shallow Foundations	CIVL 4220
13	Pile Foundations	CIVL 4220
14	2-D Flow of Water Through Soils	CIVL 4250
15	Stability of Retaining Structures	CIVL 4220