University of Manitoba	Winter XXXX
Department of Civil Engineering	CIVL 4230

Course identification	
Course name:	Geotechnical Engineering
Prerequisites:	CIVL 3730
Lecture hours:	09:30-10:20 AM MWF
Tutorial hours:	10:00-11:20 AM Tuesday

Instructor	
Instructor:	Marolo Alfaro
Contact information:	Room E1-368, Phone: 474-8155, email: alfarom@cc.umanitoba.ca
Office hours:	By Appointment

Teaching Assistants	
Teaching Assistant(s):	David Flynn, EIT, MSc Student and Zakir Hossain, PhD Student

Course description and learning objectives

This is an elective course with a pre-requisite of CIVL 3730 Geotechnical Materials and Analysis. The course is built around a case studies approach to examining geotechnical engineering applications. It focuses heavily on the use of numerical modeling tools for analyzing geotechnical problems. The course includes a number of case studies that present measured behaviour of engineering structures and lessons learned from long term performance. The cases incorporate information regarding geotechnical materials and the interpretation of their behaviour. The importance of advanced modeling tools is presented specifically looking at how these tools can help us understand the behaviour of complex physical systems.

In order to complement the course material with case histories of local practice, guest speakers will be invited to give presentations on completed engineering works, presenting details on the engineering process from conceptual design to final construction.

This course has the following objectives:

- To review aspects of limit equilibrium analysis, finite element analysis for seepage and stress deformation applications and the process of conceptualizing physical systems in a numerical framework.
- To examine special class of geotechnical problems where coupled interaction of structural and geotechnical materials play a critical role in the behaviour of civil engineering systems.
- To review and evaluate the common practice for slope stability analysis including riverbank failures.
- To evaluate the design and performance of shallow and deep foundations including various ground improvement techniques.
- To adapt engineering knowledge and skills to challenges of design, construction, and operations in cold regions.

Course web site

Your Jump Portal Server

Textbook

The following textbooks/reading materials are recommended for the course:

1) Budhu, M., *Soil Mechanics and Foundations* (2nd Edition), John Wiley and Sons, 2007.
2) Craig, R.F., *Soil Mechanics* (6th Edition), Chapman and Hall, 1997.

As much as possible, material in the course will conform to recommendations in the *Canadian Foundation Engineering Manual* (4th Edition, 2007, Canadian Geotechnical Society). Additional material will be taken from Ladanyi and Andersland: *Frozen Ground Engineering* (Wiley and Sons), Teng: *Foundation Design* (Prentice Hall), Peck, Hanson and Thornburn: *Foundation Engineering* (Wiley), Coduto: *Foundation Design* (Prentice Hall), and Bowles: *Foundation Analysis and Design* (McGraw Hill).

Assignments/group project

You are required to attend tutorials on Tuesday mornings. The tutorial sessions are done to reinforce the lectures and additional explanation. Tutorial sessions also involve the use of commercially available computer software for stress and deformation calculations and stability analyses. Assignments will be assigned regularly. They have to be submitted on or before the due date. Solutions will be provided after the assignments are marked.

The group project will be discussed in detail in class but the main objective will be that students will be expected to synthesize an understanding of soil conditions at a specific site, make suitable decisions about design parameters to be used in analysis, performed appropriate analyses, think about construction influences on the system behaviour, and recommend solutions to a range of engineering problems.

Please understand the importance of conscientiously completing assignments as an aid to understanding the course work and preparing for the examinations. Late assignments and project will be assessed a 10% reduction per day late to a maximum of 50% reduction at 5 days late. Changes to deadlines must be agreed to by the student and professor prior to the assigned deadline.

Term tests

Term Test 1: Tuesday, 05 February 2013, 10:00 - 11:30 AM, Room E2-155.
Term Test 2: Tuesday, 19 March 2013, 10:00-11:30 AM, Room E2-155.

Final exam

Three hour examination. Date and time to be arranged by Student Records Office.

Assessment method

Students will be assessed on the basis of assignments (10%), two term tests (15% each), the submission of a group project (15%) and a final examination (45%).

Students are required to achieve a passing grade in the individual, supervised assessment component of the course (combination of two term tests and final exams).

Students who do not obtain a passing grade in the individual assessment component of the course will be assigned a failing grade.

The guest lectures are considered part of the course and examinations will cover materials presented.

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.

Additional information

Please check your Jump Portal Server for periodic announcements.

Detailed course content

After a general introduction, the course will cover the following topics:

1) Earth Support Systems / Reinforced Earth

Examination of the special class of geotechnical problems where the coupled interaction of structural and geotechnical materials play a critical role in the behaviour of engineering systems. Examples include braced excavations and reinforced soil walls.

2) Geotechnical Modeling

In order to understand complex geotechnical systems we need an understanding of the analytical tools available in common practice. This section will discuss and review aspects of limit equilibrium analysis, finite element analysis for seepage and stress deformation applications and the process of conceptualizing physical systems in a numerical framework.

3) ***Shallow Foundations***

Design and performance of shallow foundations CN Tower (Edmonton, AB), and the Confederation Bridge (P.E.I.). Ground improvement techniques for lightly-loaded structures will also be discussed.

4) Deep Foundations

Design and modeling aspects of driven piles and cast-in-place concrete piles.

5) Geotechnical Structures in Cold Regions

Civil engineers must deal with the unique challenges of design, construction, and operations in cold regions. Knowledge of heat transfer processes and properties of frozen ground and frozen water is basic to most engineering activities in the cold regions. This topic will help you understand and adapt prior engineering knowledge and skills to problems of cold regions.

6) Natural Slopes and Embankments

Review and evaluation of practice for slope stability analysis including riverbank failures in Winnipeg and Hydro structures in Manitoba.