CE 357 GEOTECHNICAL ENGINEERING (Unique No.: 15990-16015)

Spring 2014

Instructor: Dr. Chadi El Mohtar
Office: ECJ 9.227B
Office Hours: - Monday 2:00 PM – 3:30 PM
- Wednesday 2:00 PM – 3:30 PM
- By appointment: ElMohtar@mail.utexas.edu

Teaching Assistant: To be Announced.

Class Hours: MWF 1:00 – 2:00 PM, ECJ 5.410 (No classes on Friday unless specified in syllabus and/or on Blackboard). Any makeup/review sessions will be scheduled on Friday with at least one week notice.

Prerequisites: EM 319 (Mechanics of Solids); CE 319F (Elementary Mechanics of Fluids).

Text: B.M. Das and K. Sobhan: Principles of Geotechnical Engineering – eighth Edition. Cengage Learning, 2013; ISBN 10: 1133108660, ISBN 13: 9781133108665.

Class Notes: El Mohtar, Chadi S., CE 357 Geotechnical Engineering Course Notes, Spring 2013, Available at the Forty Acres Press.

Lab Text: Daniel, David E., and the Geotechnical Engineering Faculty and Staff, *Laboratory Notes for CE 357 – Geotechnical Engineering*, 2013 (Available at the Forty Acres Press; Note: Author name on lab notes may vary and will not necessarily be your current instructor).

Other Materials: You will need drawing instruments (compass, protractor, straightedge, etc.) to plot data and other information for homework assignments, laboratory reports and exams. You should always bring these and a calculator to exams unless you are told otherwise.

OBJECTIVES OF COURSE & ACADEMIC/LEARNING GOALS

The objectives of CE 357 are: (1) to introduce the subject of geotechnical engineering (soil mechanics and foundation engineering) to civil engineering students; (2) to teach students how to solve certain fundamental problems related to consolidation, shear strength, and design of shallow foundations; (3) to familiarize students with relevant terms and soil tests so that they can work effectively with specialists in geotechnical engineering; and (4) to provide those students who will go on to take CE 360K (Foundation Engineering) and CE 375 (Earth Slopes and Retaining Structures) with the background needed for further study.

In this course, you will learn what soils are, how they are derived, and how they are identified and classified for engineering purposes. You will also learn the principles that govern flow of water in soils, settlement and heave of soils, and shear strength of soils. We will talk about consolidation problems and teach you how to calculate factors of safety for foundations and how to predict settlement of foundations. We will discuss actual field problems during the semester and show you how the concepts that are taught in class can be applied to understand and solve real engineering problems.

SCHEDULE

A tentative lecture schedule is attached. Reading assignments from your text are indicated on the lecture schedule. You are expected to read the appropriate assignment before the lecture. A list of texts containing introductory geotechnical engineering is provided at the end of this syllabus. If you are having difficulties in this course, you may want to consult some of these texts.

Prepared notes will occasionally be handed out in class to supplement, or in some cases to substitute for, reading material from the book. Be sure to save the notes because you may be examined over some of the material in the handouts.

GRADING

Your grade for this course will be determined on the basis of 850 points as follows:

1. Two Term Examinations (TE), each one about 50 minutes, given in class (100 points for lower grade exam and 200 points for higher grade exam)
2. Final Examination (FE) (300 points)
3. Homework (HW) (100 points)
4. Laboratory grade (LB) (100 points)
5. Class quizzes and participation (50points)

Final grades will be assigned according to the following scale: (Note that the + and – will be assigned in between accordingly).

A > 90, 80 < B < 90, 70 < C < 80, 60 < D < 70, F < 60

The instructor reserves the right to adjust the final grade cutoffs at the end of the semester; such adjustment would be by assigning lower cutoffs if found necessary (example A>88 instead of 90). Therefore, if you were to get a B, for example, on the grading scale presented above, you would get at least a B on the adjusted scale.

The final exam will be held on Friday, May 9th, 2013 from 2 PM to 5 PM.

In accordance with University regulations, students who miss examinations will receive grades of zero. Exceptions to this rule will be made only on a carefully considered individual

basis, and only if the student contacts the instructor before the exam. A *minimum exam average* of 50% is required to pass the course.

HOMEWORK

Generally, homework problems will be assigned every Monday of each week and will be due on Monday of the following week. Late homework will not be accepted except in special circumstances. Homework problems are due at the beginning of the class period. If you are ill and are unable to do your homework, contact your instructor immediately.

The primary reasons for not accepting late homework is that it is in your best interest to keep up with the work, and to have the homework graded and returned to you as quickly as possible. Also, the grader, who is also a student, has a difficult enough job without the burden of keeping up with late homework. Homework solutions will be placed using UT's Blackboard system (access on the Internet via: *courses.utexas.edu*).

You will quickly learn after college that most practicing engineers spend more time and effort communicating their ideas, analyses, and results than they do performing technical calculations. To encourage the development of these vital professional skills, your homework assignments may require a written response, and not just a simple numerical answer. In addition to engineering calculations, you might be asked to explain the important aspects of a problem, to identify the assumptions you have made, or to give some recommendations. Write your answers in paragraph form using good, technical English. When required, either use the computer or neatly draw using a straight edge, French curve, compass, etc., all sketches and data plots and show all relevant labels. As much as possible, I want your assignments to reflect real-world engineering practice where your submission to a client involves much more than calculations. Above all, present your results clearly and concisely so that someone else, who may be less knowledgeable than you are, could understand and apply your results correctly. ***Failure to submit legible, neat, professional-looking assignments will adversely affect your grade.*** Thus:

1) Work neatly.
2) Work on engineering paper, one side only (the light side).
3) Label the first assignment page as per the following example on page 4.
4) Label successive pages with name and page number/total pages.
5) Do not crowd your work.
6) Briefly state the problem.
7) Sketch and label with given data as appropriate.
8) State the quantities to be found.
9) State any assumption you make.
10) Work vertically, do not string equations horizontally.
11) Show all major steps in your calculations or reasoning, so it is clear how you proceeded.
12) Underline the answer and be sure to give proper units.
13) Do not tear pages out of books or manuals. If a problem involves completing a figure, photocopy the figure and attach it onto your solution sheets.

Important note: Copying solutions is dishonest and will result in at least failing course grade whether such occurs on homework, laboratory reports, quizzes, or exams. All work must be original.

Name Page #/total page #

Homework assignment #

For each problem

1. Problem number and brief statement of problem in your own words
2. Sketch if appropriate
3. Solution showing all major steps

CLASS QUIZZES AND PARTICIPATION

Class quizzes will be given randomly throughout the semester. The quizzes will consist of one of the homework problems submitted in the same week (or part of it). The main purpose of these 5-minute quizzes is to ensure your understanding of the covered material and your ability to demonstrate this individually. Students missing the class without prior notice to the instructor (your notice must be received before the class starts for it to be considered for a valid excuse) would get a zero on the quiz.

Class participation would be accounted for through attendance (checked occasionally and through class quizzes), asking questions in class and participating in class room discussions.

EXAMINATIONS

We will have two midterm exams, of approximately 50 minutes duration each, during the semester, and a comprehensive final exam.

The University of Texas has several rules about examinations that we will follow. For example:

(1) "Students are expected to (a) remain in the examination room until the test is completed; (b) refrain from talking; and (c) leave all notes and books where they are not accessible during the examination unless otherwise directed by the instructor."[i]

(2) There should be a final examination given at the officially scheduled time, which, for this section, is from 2 PM to 5 PM on Friday, May 9th. **Do not schedule trips, weddings, etc. at that time.**

Mandatory guidelines (failure to follow them will result in a lower grade):

1) Do not crowd your work.
2) Sketch and label with given data as appropriate.
3) State the quantities to be found.
4) State any assumption you make.
5) Work vertically, do not string equations horizontally. Do not work around figures.
6) Show all major steps in your calculations or reasoning, so it is clear how you proceeded.
7) Underline the answer and be sure to give proper units.

On occasion, students are ill on the day of an examination and are unable to attend. However, no makeup exams will be given for the exams during the semester. Makeup exams take a great deal of time to prepare and, much more importantly, it is virtually impossible to prepare a makeup exam that is equivalent to the regular exam. Regardless of how carefully one attempts to prepare a makeup exam either the student taking the exam or the other students in the class are given an unfair advantage. Instead of a makeup exam, if you miss an hour exam during the semester you will be graded on the basis of the exams which you have taken as follows: A grade for the exam that you missed will be estimated based on how you did on the other exams (includes the final exam) relative to the rest of the class. For example, if you scored twelfth among thirty students on the exams that you took, you will be given a grade for the exam that you missed that would

[i]From The University of Texas at Austin 2002-2003 General Information catalog

place you twelfth among the students who took the exam that you missed. If you miss an exam for reasons other than illness, serious, disabling injury or other valid excuse, you will be assigned a grade of zero. If you miss an exam due to illness, you may be asked to present evidence that you were, in fact, ill. If you must miss an exam, you must inform the instructor in advance of the time that the exam is given that you will miss the exam.

University class work should be given precedence over other activities, so do not plan trips or other such activities and then say you can't attend an exam.

If you have questions about the grading on exams, please see your instructor immediately. Grades on exams will only be reconsidered if brought to the attention of the instructor within one week after the date the exam is returned to the class. This is necessary because it is very difficult to remember exactly how partial credit was assigned to ensure that all grading is done on the same basis. You should be able to determine if there is a problem within the first day or two and act accordingly. No exceptions will be made to the above policy because you missed class and did not pick up your exam the day it was returned.

ATTENDANCE

Students are expected to attend all class periods and must attend all laboratory periods. Those who fail to attend class regularly are inviting scholastic difficulty and, with the approval of the Dean of the School of Engineering, may be dropped from the course with a grade of F for repeated (5 or more) unexcused absences.

Homework assignments and other material will only be returned and distributed in class.

COURSE/INSTRUCTOR EVALUATION

A formal course/instructor evaluation will be conducted in class near the end of the semester. Additionally, an anonymous midcourse evaluation would be conducted as well. This would be your chance to bring up any concerns about the course pace and the way the class is conducted.

DROP POLICY

From the 1st through the 12th class day, an undergraduate student can drop a course via the web and receive a refund, if eligible. From the 13th through the university's academic drop deadline, a student may Q drop a course with approval from the Dean, and departmental advisor. After the academic drop deadline has passed, a student may drop a course only with Dean's approval, and only for urgent, substantiated, non-academic reasons.

LABORATORY

Each student must register for a laboratory section. Laboratories for this class meet in the basement of ECJ (ECJ B.140). Your laboratory instructor will discuss grading the lab.

We are very much interested in seeing that the laboratory provides you with the education that you need without being an undue burden on your time. Please keep us informed of any problems that you are having with your laboratory or with your laboratory instructor.

You will not be allowed to pass this course if you do not attend all laboratories. Please consult your professor and your laboratory instructor if you feel you have to miss a laboratory so that some type of makeup can be scheduled ***in advance***.

STUDENTS WITH DISABILITIES

The University of Texas at Austin provides upon request appropriate academic accommodations for qualified students with disabilities. For more information, contact the Division of Diversity and Community Engagement, Services for Students with Disabilities, 471-6259 (voice) or 232-2937 (video phone) or http://www.utexas.edu/diversity/ddce/ssd .

FINAL COMMENT

Good luck to all of you in this course. Please do not hesitate to ask questions in class, or if necessary, to see your instructor outside of class. Any specific comments that students have on how the course might be improved are particularly welcomed (either through personal communication, midcourse or final/ formal course/instructor evaluation).

SUPPLEMENTAL REFERENCE LIST

Most of the following books are available at either the Engineering Library, or the Geology Library. Please consult them if you have difficulties in the course.

Cernica, J.N., *Geotechnical Engineering*, (1994)

Craig, R.F., *Soil Mechanics*, 3rd Ed, (1983)

McCarthy, Essentials of Soil Mechanics and Foundations – Basic Geotechnics, Prentice-Hall, 4th Ed. (1993), 5th Ed. (1998), 6th Ed. (2002)

Sowers, G.F., *Introductory Soil Mechanics*, 4th Ed., (1979)

Holtz, R. and Kovacs, W., *An Introduction to Geotechnical Engineering*, Prentice-Hall (1981).

Lambe, T.W. and Whitman, R., *Soil Mechanics*, John-Wiley and Sons (1979)

CE 357 - TENTATIVE OUTLINE AND SCHEDULE – Spring 2014

Lecture	Date	Topic	Assigned Reading	HW
1	01/13(M)	Introduction	Chapter 1, 2.1-2.3	
2	01/15(W)	Weight-Volume Relationships	2.6, 3.1-3.5	
	01/20(M)	MLK Day holiday		
3	01/22(W)	Weight-Volume Relationships (cont'd); Index Tests, Soil Classification	2.7-2.9, 3.6-3.7	1
4	**01/24(F)***	Index Tests, Soil Classification (cont'd)	4.1-4.7	
5	**01/31(F)***	Site Investigations; Boring and Sampling	17.1-17.5	2
6	02/03(M)	Darcy's Law	7.1-7.5	
7	02/05(W)	Darcy's Law(cont'd)	7.1-7.5	3
8	**02/07(F)***	Total and Effective Stress	9.1-9.2	
9	02/10(M)	Stresses Cont'd, Uplift, Quicksand	9.3-9.5; 9.9,9.10	
10	02/12(W)	Capillarity and Introduction to Compaction	6.1-6.11	4
11	02/17(M)	Compaction	6.1-6.11	5
	02/19(W)	***Review session - optional***		
12	**02/21(F)***	**EXAM No. 1** (Covers Lectures 1-10)		
13	**02/28(F)***	Introduction to Consolidation	11.4	
14	03/03(M)	One-Dimensional Consolidation	11.4-11.7, 11.10-11.13	6
15	03/05(W)	One-Dimensional Consolidation (continued)	"	
16	03/17(M)	Time-Rate of Settlement	11.14-11.15	7
17	03/19(W)	Time-Rate of Settlement (continued)	"	
18	03/24(M)	Surcharge and Preload	11.18-11.19	8
19	03/26(W)	Mohr's Circle of Stress	10.1-10.3	
	03/28(F)*	***Review session - optional***		
20	**03/31(M)**	**EXAM No. 2** (Covers Lectures 12-18)		
21	04/02(W)	Shear Strength of Soil: Introduction	12.1-12.2	9
22	04/07(M)	Measurement of Shear Strength- Direct Shear	12.4-12.5	
23	04/09(W)	Triaxial Compression Tests	12.4,12.6-12.12	10
24	04/14(M)	Shear Strength of Sand	"	
25	04/16(W)	Shear strength of Clay	"	11

***Class meeting on Friday.**

CE 357 - TENTATIVE OUTLINE AND SCHEDULE – Spring 2014 (continued)

Lecture	Date	Topic	Assigned Reading	HW
26	04/21(M)	Stress Distribution	10.4; 10.7; 10.11-10.13	
27	04/23(W)	Introduction to Bearing Capacity of Shallow Foundations	16.1-16.6	12
28	04/28(M)	Settlement of Footings on Clay	11.1-11.3	
29	04/30(W)	Settlement of Footings on Sand		
	05/02(F)*	***Review session & Course Evaluation***		
	05/09 (F)	**Final Exam 2 PM - 5 PM (comprehensive)**		

***Class meeting on Friday.**

CE 357 - LABORATORY SCHEDULE – Spring 2014

Week of:	Monday	Tuesday	Wednesday	Thursday	Friday
Jan 13	- no lab -	- no lab -	- no lab -	- no lab -	- no lab -
Jan 20	No Lab-MLK Day	Water Content	Water Content	Water Content	Water Content
Jan 27	Water Content and Specific Gravity	Specific Gravity	Specific Gravity	Specific Gravity	Specific Gravity
Feb 3	Grain Size	Grain Size	Grain Size	Grain Size	Grain Size
Feb 10	Atterberg Limits, Classification	Atterberg Limits, Classification	Atterberg Limits, Classification	Atterberg Limits, Classification	Atterberg Limits, Classification
Feb 17	Visual-manual soil classification	Visual-manual soil classification	Visual-manual soil classification	Visual-manual soil classification	Visual-manual soil classification
Feb 24	Hydraulic Conductivity	Hydraulic Conductivity	Hydraulic Conductivity	Hydraulic Conductivity	Hydraulic Conductivity
Mar 3	Compaction	Compaction	Compaction	Compaction	Compaction
Mar 10	Spring Break	Spring Break	Spring Break	Spring Break	Spring Break
Mar 17	Consolidation (set up/loading)	Consolidation (set up/loading)	Consolidation (set up/loading)	Consolidation (set up/loading)	Consolidation (set up/loading)
Mar 24	Consolidation (loading)	Consolidation (loading)	Consolidation (loading)	Consolidation (loading)	Consolidation (loading)
Ma 31	Consolidation (data reduction)	Consolidation (data reduction)	Consolidation (data reduction)	Consolidation (data reduction)	Consolidation (data reduction)
Apr 7	Direct Shear		Direct Shear	Direct Shear	Direct Shear
Apr 14	Unconfined Compression, Lab Vane	Unconfined Compression, Lab Vane	Unconfined Compression, Lab Vane	Unconfined Compression, Lab Vane	Unconfined Compression, Lab Vane
Apr 21	Q-type Triaxial Test	Q-type Triaxial Test	Q-type Triaxial Test	Q-type Triaxial Test	Q-type Triaxial Test
Apr 28	Final Lab Meeting	Final Lab Meeting	Final Lab Meeting	Final Lab Meeting	Final Lab Meeting