

# CE 215(B) – Fundamentals of Geotechnical Engineering

Department of Civil, Architectural & Environmental Engineering

University of Missouri-Rolla

FALL 2007

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**Dr. Luna's Office Hours:** Wed. 2:00pm – 5:00pm, and by appointment.

**Course Objective:** To provide an introduction to theoretical and practical soil mechanics, to perform testing of soil materials as used in practice, and to apply soil mechanics concepts. *See: Student Learning Goals, in subsequent section.*

**Course Description (from catalog):** [LEC 2.0, LAB 1.0] Analysis of geotechnical systems including soil classification, index properties, permeability, compressibility and shear strength. Basic geotechnical engineering design principles as they apply to civil constructed facilities, such as analysis of foundations and earth structures. Laboratory determination of the basic properties of soils. Prerequisite: Geo Eng 50 preceded or accompanied by IDE 110; or Arch Eng 103.

## Meeting Times:

**Lecture:** Mon, Wed & Fri, 11:00-11:50 AM; Butler-Carlton Hall, Rm. 121

**Laboratory:** Section 3C Wed. 1:00-3:00 PM; Butler-Carlton Hall, Rm. 114

Section 3D Wed. 3:00-5:00PM; Butler-Carlton Hall, Rm. 114

## Course Textbook (required):

Coduto, D.P., *Geotechnical Engineering – Principles and Practices*, Prentice Hall, New Jersey, 1999.

## Laboratory Manual (recommended):

We will provide handouts for each lab, but for further detail on laboratory we recommend:

- Bowles, J.E., *Engineering Properties of Soils and their Measurement*, 4th edition, McGraw Hill, 1992.

**Course Website:** <http://blackboard.umr.edu>

## Homework:

HW is assigned on a weekly basis. Assignments are DUE at the beginning of class on due date.

## Grading:

Homework	20%	
Laboratory	20%	
3 - Hour Exams	45%	(15% each)
Final Exam (Comprehensive)	15%	

What follows is a listing of the minimum learning goals expected for students of CE 215. These have been developed to aid students in knowing the minimum subject areas and depth they will be expected to know for this course, to succeed in CE 229 and to carry with them after graduation. One of the most important things which will be stressed this semester will be thinking about how to use information learned to extrapolate into situations not seen before. Therefore, students should not expect the same type of questions and problems assigned on homework to be on the hour quizzes or final exam. The final goal is for students to be able to integrate all that is learned in this course into concepts of soil mechanics, which can be applied to practical engineering situations.

- A. Knowledge of what to expect as the constituents and their arrangement in soil formations of all major types.
- B. Knowledge of soil types, their basic mineralogy and how this affects their engineering behavior.
- C. Know basic soil grain-to-grain structures and macro structures, how they form, and how these affect the soil mass engineering behavior.
- D. Understanding of index properties, why they are displayed by the soil, and what they mean as to the predicted engineering behavior of the soil.
- E. Be able to classify soils using the Unified Soil Classification System and AASHTO.
- F. Have a complete understanding of how to use 3-phase diagrams to describe soil mass properties and configurations.
- G. Knowledge of civil engineering earthworks (excavation, grading and compaction) for all types of soils, to include laboratory testing required and expected results, required field specifications, basic field construction practice, and field monitoring.
- H. Knowledge of the flow of fluids through soil masses, along with how flow nets are constructed and interpreted to predict flow rates and fluid pressures within the soil mass.
- I. General knowledge of the basic principles of control of surface and subsurface water for engineering purposes.
- J. Determination of earth pressures (stresses) caused by overburden, water tables, and footings placed on and in the soil mass. This includes especially total stress, pore water pressures and effective stresses.
- K. Knowledge of basically what causes volume loss and increase in soil masses, how to predict compression of the soil mass from effective stress increase, and how to predict the time required for such volume change to occur.
- L. Enough knowledge about the shear strength of soil masses and what affects this strength to be able to predict the expected strength parameters, including the influence of pore pressures, for general types of soils.
- M. Basic knowledge of the laboratory testing normally used in the practice of geotechnical engineering, the expected results from this testing and how it can be applied to soil mechanics.
- N. Be able to apply the fundamental concepts of soil mechanics into the field of geotechnical engineering.
- O. Basic knowledge regarding the stability of slopes and stabilization methods.
- P. Knowledge of the principles of the design of structural foundations for both bearing capacity and settlement considerations.
- Q. Understanding of the design considerations of earth retention systems.

**BEFORE****Sections A1 and A1****LABORATORY SCHEDULE****Fall 2003**

<b>Week</b>	<b>Laboratory Title</b>	<b>Reporting</b>
Aug. 25	Geotechnical Investigations	In-lab report
Sep. 1	Labor Day Week – NO LAB ☺	---
Sep. 8	Sampling, Lab Test Assignments, and Visual Classification	In-lab data report
Sep. 15	Grain Size Distribution (Sieve and Hydrometer)	<b>Report #1</b>
Sep. 22	Atterberg Limits and Associated Indexes	
Sep. 29	Proctor Compaction Testing	<b>Report #2</b>
Oct. 6	Groundwater Applications	In-lab exercises
Oct. 13	Constant Head Permeability Test	<b>Report #3</b>
Oct. 20	Applied Soil Mechanics Lab Demos & Exercises	In-lab exercises
Oct. 27	Consolidation Testing	<b>Report #4</b>
Nov. 3	Consolidation Testing	
Nov. 10	Consolidation Testing	
Nov. 17	Shear Strength: Direct Shear Test	<b>Report #5</b>
Nov. 24	Thanksgiving Break – NO LAB ☺	
Dec. 1	Shear Strength: UCT and Triaxial Test (Demo)	
Dec. 8	Final Exam Preparation & Problem Solving	---

**Note:** The objective of this laboratory experience is for you to understand the engineering needs for soil testing in civil engineering. Even though you will be learning many details involved in the testing procedures (dos and don'ts), we are not training you to be technicians. We are training you to be engineers that can assign testing programs and manage technical laboratories in civil engineering.

# AFTER

CE 215

## LABORATORY SCHEDULE

Fall 2007

Week	Laboratory Title	Reporting	Due Date
Aug. 20	Geotechnical Investigations	In-Lab Exercise	End of Lab
Aug. 27	Sampling, Lab Test Assignments and Visual Classifications	In-Lab Exercise	End of Lab
Sept. 3	Labor Day- No Lab		
Sept. 10	Particle Size Analysis (Sieve and Hydrometer)	Report #1	Sept. 24
Sept. 17	Atterberg Limits and Associated Indexes		
Sept. 24	Proctor Compaction Testing	Report #2	Oct. 1
Oct. 1	Borrow Soil Sites – GIS Lab (Meet in Rm. 115)	In-Lab Exercise	End of Lab
Oct. 9	Constant Head Permeability Test	Report #3	Oct. 15
Oct. 15	Groundwater Applications (Flow nets and more...)	In-Lab Exercise	End of Lab
Oct. 22	Consolidation Testing	Report #4	Nov. 12
Oct. 29	Consolidation Testing		
Nov. 5	Consolidation Testing		
Nov. 12	Shear Strength: Direct Shear Test	Report #5	Nov. 26
Nov. 19	No Lab – Happy Thanksgiving		
Nov. 26	Slope Stability Analyses – Computer Lab	In-Lab Exercise	End of Lab
Dec. 3	Shear Strength: UCT and Triaxial Test Demo	Report #6	Dec. 10

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