53:030 SOIL MECHANICS
Department of Civil & Environmental Engineering
The University of Iowa
Fall Semester, 2005

Instructor:
Colby C. Swan, Associate Professor
4120 Seamans Center
E-mail: colby-swan@uiowa.edu
Phone: 335-5831
Office Hours: T 10:30-noon; W 9-10:30am

Textbook:
Principles of Geotechnical Engng. 5th Ed.
Braja M. Das; Brooks/Cole Publishers, 2001
ISBN: 053438742X

Reference texts available on reserve in the Engineering Library

Soil Mechanics & Foundations
Muni Budhu
John Wiley, 2000.

Fundamentals of Soil Behavior, 3rd Ed.
James K. Mitchell, Kenichi Soga
Wiley, 2005.

Teaching Assistants:

Mr. Peter Hansen, Lab instructor
1431 SC
pahansen@engineering.uiowa.edu

Mr. Jun Yang, Homework grader
3225 SC
jyang8@engineering.uiowa.edu

Laboratory Schedule and Topics Covered

Week of:	Lab #	Topics Covered
Aug. 29	1	Specific gravity of soil solids
Sept. 05	2	Grain-size distribution measurements
Sept. 12	3	Liquid and plastic limit measurements
Sept. 19	4	Shrinkage limit measurement
Report #1 on Labs 1-4 due September 30th		
Sept. 26	5	Constant head permeability tests
Oct. 03	6	Seepage computations using FEM
Oct. 10	7	Measurement of pore pressures, seepage forces, liquefaction
Report #2 on Labs 5-7 due October 24th		
Oct. 17	8	1-D compression of dry sand
Oct. 24	9	1-D consolidation of fine-grained soil
Oct. 31	10	2-D consolidation computations using FEM
Report #3 on Labs 8,9 due November 14th		
Nov. 07	11	Shear strength of sand: direct shear testing
Nov. 14	12	Shear strength of sand: triaxial compression testing
Report #4 on Labs 11, 12 due December 5th		
Nov. 28	13	Compaction and moisture-density studies

Course grading guidelines:

Homework assignments:	25%
In-class quizzes	5% (Bonus points)
Lab reports	25%
Mid-term exams (2)	25%
Final exam	25%

Class period #	Date	Topic	Related reading
1	Aug. 22	Intro. to soil mech. & geotech. engng.	Ch. 1
2	Aug. 24	Grain-size distributions	Ch. 2
	Aug. 29	No class, Labor Day	
3	Aug. 31	Particle characteristics; size effects	
4	Sept. 05	Phase-Mass-Volume Relations	Ch. 3
5	Sept. 07	Soil structure; water and consistency	
6	Sept. 12	Soil classification systems	Ch. 4
7	Sept. 14	Concepts for 1-D fluid flow in soil	Ch. 6
8	Sept. 19	Permeability and its measurement	
9	Sept. 21	Flow in parallel and series	
10	Sept. 26	Mass conservation and flownets	Ch. 7
11	Sept. 28	Applications with flownets	
12	Oct. 03	Pore pressures, effective stresses	Ch. 8
13	Oct. 05	Seepage forces and liquefaction	
14	Oct. 10	Partially saturated soil, capillarity	
15	Oct. 12	Compressibility of soils, e vs. log p	Ch. 10
16	Oct. 17	Normal- and over-consolidation	
17	Oct. 19	Consolidation model for saturated soils	
Evening, 7pm	Oct. 19	Midterm Exam #1 over Ch.1-4, 6-8	
18	Oct. 24	Applications of consolidation model	
19	Oct. 26	Interpreting results of 1-D consol. tests	
20	Oct. 31	Linear elastic stress solutions in soil.	Ch. 9
21	Nov. 02	Mohr's circle and shear stresses	
22	Nov. 07	Mohr-Coulomb shear failure criterion	Ch. 11
23	Nov. 09	Pore pressure effects & shear strength	
24	Nov. 14	Drained and un-drained soil strengths	
25	Nov. 16	Applications of shear strength models	
	Nov. 21	No class. Holiday break.	
	Nov. 23	No class. Holiday break.	
26	Nov. 28	Compaction and Soil Improvement	Ch. 5
27	Nov. 30	Moisture-densities on compacted soil	
Evening, 7pm	Nov. 30	Midterm Exam #2 over Ch. 9-11	
28	Dec. 05	Field compaction methods, techniques	
29	Dec. 07	Review for final examination	
Wednesday Dec. 14th	9:45 am 3505 SC	Comprehensive final examination.	Ch. 1-11

Course Learning Objectives:

1. To appreciate soil as a vital construction material and soil mechanics in the engineering of civil infrastructure.
2. To understand relationships between physical characteristics of soils and mechanical characteristics such as conductivity; strength; compressibility.
3. To learn how to measure both physical and mechanical characteristics of soils through hands-on practice in the lab.
4. Understand the modeling techniques commonly used in soil mechanics and how to apply them. Examples here include:
    a. Darcy's law and flownets when computing two-dimensional seepage;
    b. Consolidation models for load-time-deformation response of soils;
    c. Mohr-Coulomb shear strength modeling of soils.
5. Development of good technical reporting and data presentation skills.

Expected Outcomes:

Upon successfully completing this course, it expected that you would be able to:

1. Apply fundamental concepts learned previously or concurrently in mathematics, statics, mechanics of deformable bodies, and fluid mechanics to the solution of soil mechanics problems in civil and environmental engineering.
2. Explain the difference between different types of soils in terms of both physical and mechanical characteristics.
3. Perform the common tests used to measure soils' physical and mechanical properties and know how to interpret results from such tests.
4. Apply fundamental soil mechanics principles to common civil engineering applications including:
    a. Compute time-dependent settlement of a soil deposit after a load is applied.
    b. Compute the seepage of groundwater into a constructed excavation, and to assess liquefaction potential.
    c. Compute the magnitude of loads that can be applied to a geomechanical system safely without inducing shear failure.
5. Write professional quality, clear concise technical reports and letters.

Homework Assignments & Tentative Due Dates

Assignment #	Due Date	Assignment
1	9/07	2:1,2,3,5,6,8,9,10,11
2	9/14	3:1,2,4,5,7,8,10,11,15,17,18,19,20,22
3	9/21	4:1,3,4,5
4	9/28	6:1-19, even numbered problems
5	10/05	7:1-4 + supplemental
6	10/12	8:2,3,6,7,8,9,10,11 + supplemental
7	10/21	8:13-16; 10:3
8	10/26	10:5,6,8,11,12,13
9	11/02	10:10,14,15,16,17,18,19,20
10	11/09	9:1-21, odd numbered problems
11	11/16	11:1-13, odd numbered problems
12	12/02	11:16-19,21,23,26
13	12/07	5:1-12, even numbered problems