UNIVERSITY OF PORTLAND
SCHOOL OF ENGINEERING

CE 422 - Geotechnical Design

(MWF 11:25-12:20)
Spring Semester, 2008

Instructor: Dr. Matthew R. Kuhn (Room ???, 943-7361, kuhn@up.edu)

Office Hours:

Text: Donald P. Coduto, *Foundation design: Principles and practices*, Prentice-Hall, Upper Saddle River, New Jersey, 2001. http://www.prenhall.com/coduto

Donald P. Coduto, *Geotechnical Engineering: Principles and Practices*, Prentice-Hall, Upper Saddle River, New Jersey, 2001. http://www.prenhall.com/coduto

Course Learning Objectives: By the end of this course . . .

- You will know how to do the geotechnical design of the most common types of foundations and earth structures.
- You will understand the fundamentals of soil behavior as they relate to foundations, retaining structures, and embankments.

Requirements:

Homework & Quizzes	25 %	Homework: 160pts, Quizzes: 40pts
Examination 1	20 %	
Examination 2	20 %	
Final Examination	35 %	

Learning objectives and outcomes	**Assessment**
1. Knowledge and comprehension of geotechnical engineering vocabulary and concepts a) Knows and can recall definitions of words at the ends of text chapters b) recognizes and can explain words at the ends of text chapters	Quizzes
2. Application of geotechnical design principles with calculations a) Can use SPT and CPT results to estimate soil strength b) can compute the factor of safety for the stability of a clay slope by using charts, with appropriate adjustments c) can compute the factor of safety for the stability of a slope using the ordinary method of slices d) can compute the earth pressures against a concrete retaining wall due to soil weight, water pressures, and surcharge loads, by using both equations and charts	Homework Examinations

e) can estimate appropriate soil characteristics for use in determining earth pressures against a wall
f) can evaluate the external stability of a concrete gravity or cantilever retaining wall
g) can evaluate the internal and external stability of a mechanically stabilized earth wall
h) can estimate passive earth pressures and use them to evaluate wall stability
i) can compute bearing pressures beneath a footing
j) can compute the bearing capacity of a footing, including the effects of depth, width, load eccentricity, load inclination, and footing shape
k) can estimate appropriate strength and stiffness parameters for footing design from the result of SPT, CPT, and plate bearing tests
l) can estimate the distortion settlement of a footing by using both the Skempton and Schmertmann methods
m) can find the required size a footing foundation, accounting for both strength and settlement concerns
n) can estimate the toe bearing and side friction capacities of a single piles using the Kulhawy, alpha, and effective stress methods
o) can numerically estimate pile settlement by using t-z curves
p) can compute earth pressures for braced excavation systems
q) can estimate the stability of a braced excavation

Homework

Grading

Numeric scores will be assigned on each homework assignment, based on the following approach.

Proper use of equations and correlations	50%
Accuracy	25%
Presentation	25%

Guidelines

a. You are encouraged to work independently, but if you do work with others, give them credit on the first page. Failure to give credit is discourteous and will be penalized 25%.
b. Homework is due at the beginning of class. Late homework will not be accepted.
c. Every homework assignment will count toward the final grade.
d. Include a cover page with each homework set.
e. Use either square grid engineering paper, blank (white) paper, or recycled paper.
f. Include a cover page with each homework set.
g. Print on only one side of the paper.

h. Staple pages together.

i. You do not need to rewrite the problem statement, but you should begin each problem with the following introduction:

   Given: Briefly describe the conditions of the problem. If you think that some necessary information was not given in the problem statement, then clearly state your chosen assumption.

   Required: Briefly describe what is required in your problem.

   Calculations: Your calculations.

j. Be neat. Present your calculations in an orderly, linear fashion, explaining important steps and assumptions.

k. Every number that you use in your calculations should be given with its units.

l. Underline the final answer, *with its units*. You should give your answer with an appropriate number of significant figures that is consistent with the precision of the given data and your idealizations.

Quizzes

Quizzes will occasionally be given, as shown in the lecture schedule. The quizzes will cover the definitions and understanding of words in the text vocabulary lists. The quiz grading will be as follows: A (90%+), B (80%+), C (70%+), D (50%+), F (F50%+).

Examination Policy:

You should not expect the examination questions to be the same as those given in the homework assignments. Just as homework questions require different solution methods (rather than repetitive drill), examination questions will likely be different than those in homework assignments.

There will be no make-up examinations and no credit for missed examinations.

Academic Integrity:

The University's Code and Guidelines of Academic Integrity are available on the web (www.up.edu > Academics > Registrar > Academic Regulations). Students should read and be familiar with the code and guidelines and should be aware of the various types of violations: cheating, forgery, and plagiarism. In this course, all violations will be considered as being of Level 2 or higher.

Accommodation for Disability:

If you have a disability and require an accommodation to fully participate in this class, contact the Office for Students with Disabilities (OSWD), located in the University Health Center (503-943-7314), as soon as possible.

If you have an OSWD Accommodation Plan, you should make an appointment to meet with Dr. Kuhn to discuss your accommodations. Also, you should meet with Dr. Kuhn if you wish to discuss emergency medical information or special arrangements in case the building must be evacuated.

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Syllabus

Spring Semester, 2008

No.	Date	Topics	Text Reading	H.W. (due)
1	1-14	**Introduction and review** Combined stresses		No. 1 (3) 10pts
2	1-16	Effective stress concept Consolidation		
3	1-18	Soil strength In-situ testing, SPT methods	pp. 102-124	No. 2 (6) 10pts
4	1-21	In-situ testing, CPT, PMT, DMT methods	pp. 124-138	
5	1-23*	**Slope stability** Causes of instability	14.1-14.2	
6	1-25	Slip circle analysis	14.4(pp.528-539), pp. 535-539)	No. 3 (9) 20pts
7	1-28	Slip circle analysis, cont. Ordinary method of slices	14.4(pp. 539-542)	
8	3-30*	Ordinary method of slices, cont.		
9	2-1	Stability charts		
10	2-4	**Lateral soil pressures and earth retaining structures** At-rest pressures Rankine theory	22.1-22.3, pp. 618-622, 23.4	No. 4 (13) 15pts
11	2-6	Effect of water pressure Cohesive soils	23.7, 24,4 23.3	
12	2-8	Coulomb theory	pp. 763-766	
13	2-11*	Passive earth pressures Surface surcharge loads Equivalent fluid method	23.6	
14	2-13	Retaining wall design	23.5 22.1,24.1	No. 5 (17) 25pts
15	2-15	Retaining wall design, cont.	24.2	
16	2-18	Mech. stabilized earth walls	22.2	
17	2-20	Mech. stabilized earth walls, cont.		No. 6 (19) 10pts
18	2-22	Mech. stabilized earth walls, cont. **Bearing capacity and shallow foundations** Spread footings Bearing pressures	6.1	

19	2-25	Bearing capacity factors Bearing capacity adjustments	6.2	No. 7 (23) 10pts
20	2-27	Effects of shallow water table Allowable bearing capacity	6.3 8.2	
21	2-29	Eccentrically loaded footings Settlement criteria	6.4-6.5 2.3	
22	3-3	Examination No. 1		
23	3-5	Settlement criteria, cont. Elastic settlements	7.1 7.4(pp. 224-228)	No. 8 (26) 15pts
24	3-7	Elastic settlements, cont.	7.6(pp. 233-239)	
25	3-17	Consolidation settlements	7.4(pp. 217-224)	No. 9 (29) 20pts
26	3-19	Consolidation settlements, rate		
27	3-26	Geotechnical footing design	7.9,8.1	
28	3-28	**Deep foundations** Pile and pier foundations	11.1-11.3 pp. 373-386	
29	3-31	Pile installation Pile driving stresses Load transfer mechanism	11.3(pp. 389-400)	
30	4-2	Pile capacity Pile load tests	13.1 13.2-13.3	No. 10 (33) 10pts
31	4-4*	Pile capacity, tip bearing Pile capacity, side friction	14.2(pp. 500-501 & p. 509) 14.3(pp. 513-516 & 522-526)	
32	4-7	Estimating pile settlements		No. 11 (36) 15pts
33	4-9	Estimating pile settlements, cont. Pile driving mechanics	15.1-15.3	
34	4-11	Pile group capacity	14.6	
35	4-14	Drilled shaft installation	11.4	
36	4-16	**Excavation bracing** Installation methods		
37	4-18	Ground movements Earth pressures for bracing design		
38	4-21	Examination No. 2		
39	4-23	Stability of excavations		
40	4-25	Soil nailing		
		Course Review		
	May 1	(Thursday)		
	10:30-12:30	*Final Examination*		