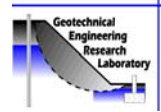




Geotechnical Engineering Research Laboratory
One University Avenue
Lowell, Massachusetts 01854
Tel: (978) 934-2277 Fax: (978) 934-3046
e-mail: Samuel_Paikowsky@uml.edu
web site: http://www.uml.edu/research_labs/Geotechnical_Engineering/
**DEPARTMENT OF CIVIL AND
ENVIRONMENTAL ENGINEERING**

Samuel G. Paikowsky, Sc.D
Professor



14.533 ADVANCED FOUNDATION ENGINEERING

Fall 2010

Wednesday, 6:00 – 8:50PM, KI-306

Recommended Textbook: "Foundation Analysis and Design", Joseph E. Bowles, 5th. ed., 1996, McGraw Hill.

The class does not follow any specific text. The above reference is recommended with additional material from different sources to be distributed. The following reference texts will be used and/or referred to.

Class Website: <http://faculty.uml.edu/spaikowsky>

Reference Texts:

1. *Foundation Engineering Handbook*, edited by Hsai-Yang Fang, Van Nostrand, 2nd ed. (1991).
2. *Principles of Foundation Engineering*, B.M. Das, PWS-Kent, 5th ed. (2004), 6th ed. (2006), and 7th ed. (2010).
3. *NCHRP Report 651 LRFD Design and Construction of Shallow Foundations for Highway Bridge Structures*, Paikowsky et al., 2010.
http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_651.pdf (Google "NCHRP 651")
4. *Soil Mechanics, and Foundations and Earth Structures*, NAVFAC DM7.1 and 7.2, May 1982.
5. *Soils and Foundations*, Workshop Manual, National Highway Institute, NHI course No. 132012, Pub. No. FHWA-HI-88-009 <http://www.nhi.fhwa.dot.gov/home.aspx>
6. *Geotechnical Engineering Circular No. 5 – Evaluation of Soil and Rock Properties*, Sabatini et al., Pub. No. FHWA-IF-02-034, 2002.
http://www.fhwa.dot.gov/engineering/geotech/library_listing.cfm
7. *Geotechnical Engineering Circular No. 6 – Shallow Foundations*, Kimmerly, Pub. No. FHWA-IF-02-054, 2002. http://www.fhwa.dot.gov/engineering/geotech/library_listing.cfm
8. *Canadian Foundation Engineering Manual*, Canadian Geotechnical Society, 3rd ed (1992), 4th ed. (2007).
9. *Shallow Foundations*, NHI Course No. 13237 – Module 7, June 1999.
10. *Manual on estimating soil Properties for Foundation Design*, EPRI EL-6800, Aug.1990.
http://www.geoengineer.org/EPRI_reports/EL-6800.pdf
<http://my.epri.com/portal/server.pt> then search "EL-6800" for PDF download
11. *Manuals for the Design of Bridge Foundations*, Transportation Research Board, NCHRP Report. #343.
12. *Steel Sheet Piling Design Manual*, USS, reprint by FHWA, 1984.
13. *Load and Resistance Factor Design (LRFD) for Highway Bridge Substructures*, NHI Course No. 13068, July 1998.
14. *Foundation Analysis*, R.F. Scott, Prentice-Hall, 1981

Web Sites

FHWA Geotechnical Publications:

<http://www.fhwa.dot.gov/bridge/geopub.htm>

FHWA Geotechnical Software:

<http://www.fhwa.dot.gov/bridge/geosoft.htm>

US Army Corps of Engineers – Engineering Manuals

<http://www.usace.army.mil/inet/usace-docs/eng-manuals/em.htm>

Geotechnical Software Directory

<http://www.GGSD.com>

Software

1. A simple straightforward Geotechnical Software package by the name of GEOPRO 4.0 (by DataSurge, Bradford, MA). In most cases this software will be used for verification/check of hand calculations only. The software is up and running in the PC lab. You need to go in and select the specific application as the general icon is not active. This package is capable of carrying out a variety of analyses including those that are relevant to the class:
2. Stress distribution – Vertical stress below surface and lateral stress due to surcharge.
3. Settlement Analyses - consolidation, immediate settlement, time rate settlement
4. Foundation Design - bearing capacity
5. Retaining Structures - earth pressures, cantilever sheet pile wall (clay and sand), anchored sheet pile wall
6. LimitState geo version 2.0 by Limitstate Ltd., UK
7. WALLAP version 5.0, 2000 by Geosolve
8. DEEP2010, Deep Excavation Engineering Program

Final Grade

The approximate grade components are:

- | | |
|---|-----|
| 1. Attendance and guest lecture summaries | 10% |
| 2. Homework and computer exercises | 25% |
| 3. Project | 25% |
| 4. Final Exam | 40% |

Planned Schedule

1. Attached please find the outline of the planned schedule. The classes consist of regular and guest lectures. Your participation in the events is mandatory and will be considered part of your grade.
2. In the meeting following each of the guest lectures, you will be required to submit a short (1 to 2 page) typed summary, based on your notes during that lecture.
3. Each of the students will conduct an independent project according to the attached material. The final grade of the project will consider your performance during all of the required stages, i.e. preparation submittal, manuscript, review and presentation.
4. There will be a final exam currently planned for December 08, 2010.

<u>Class #</u>	<u>Date</u>	<u>Topic</u>	<u>Text</u>
1	Wed 9/01/10	<ul style="list-style-type: none"> • Introduction, Definitions, Classification, • Overview Geotechnical Engineering • Field and Lab Classification of Soils and Rocks 	Chaps. 1 & 3
2	Wed 9/08/10	<ul style="list-style-type: none"> • Substitute Lecturer Prof. Edward Hajduk • Soil and Rock Identification • Site Exploration 	
3	Wed 9/15/10	<ul style="list-style-type: none"> • Guest Lecture by the Hydrogeologist Mr. David Adilman of GeoSyntec Consultants: "Subsurface Explorations and the Geology of the New England Area" • Site Exploration (cont'd) • In-Situ Measurements and Laboratory Testing • Submittal of Project Title/ Description/ Extent 	Chap. 3 Chap. 3
4	Wed 9/22/10	<ul style="list-style-type: none"> • In-Situ Measurements and Laboratory Testing (Cont'd) • Limit Equilibrium and Limit Analysis Theories, Bearing Capacity of Shallow Foundations 	Chap. 4
5	Wed 9/29/10	<ul style="list-style-type: none"> • Bearing Capacity of Shallow Foundations, (Cont'd) Different Influencing Factors e.g.: Eccentric and Inclined Loading, Layered Soils, Slopes, Water. • B.C. Analysis - Examples 	Chap. 4
6	Wed 10/06/10	<ul style="list-style-type: none"> • B.C. Analysis – Reliability of Analysis • Short and Long Term Settlement Analysis of Shallow Foundations 	Chap. 5
7	Wed 10/13/10	<ul style="list-style-type: none"> • Short and Long Term Settlement Analysis of Shallow Foundations (cont'd.) • Reliability of Settlement Analysis • Submittal of Project Abstract, Headings and References 	
8	Wed 10/20/10	<ul style="list-style-type: none"> • Flexible and Rigid Beams on Elastic Foundation • Mat Foundation 	Chaps. 9 Chap. 10
9	Wed 10/27/10	<ul style="list-style-type: none"> • Lateral Earth Pressure at rest, active, passive and following Compaction 	Chap. 11
10	Wed 11/03/10	<ul style="list-style-type: none"> • Retaining Structures Including Gravity Walls and Sheet Pile Walls 	Chaps. 12&14
	Wed 11/10/10	No class – Thursday Class Schedule	
11	Wed 11/17/10	<ul style="list-style-type: none"> • Design of Sheet Pile Walls • PROJECT Due Date 	Chap. 13
12	Wed 11/24/10	<ul style="list-style-type: none"> • Seismic Design of Footings and Walls • Load Resistance Factor Design (LRFD) of Shallow Foundations • Project Review is Due 	
13	Wed 12/01/10	<ul style="list-style-type: none"> • Project Presentations 	
14	Wed 12/08/10	<ul style="list-style-type: none"> • FINAL EXAM 	

14.533 ADVANCED FOUNDATION ENGINEERING

Fall 2010

Term Project

As part of the Advanced Foundations Engineering class you are required to prepare and present a term project. The project may consist of one or more of the following: literature survey, computer program, case history, data analysis or laboratory study. Any topic relevant to Geotechnical or Geo-Environmental Engineering may be applicable.

The project will be submitted typed (double spaced) and will not exceed 20 pages including figures and references. All projects should contain an abstract, table of contents, statement of engineering significance and relevance, conclusions, and a list of references.

Work on the project will proceed according to the following **steps and time schedule:**

9/01 & 9/08	Choose a topic and discuss it's acceptability with the instructor.
9/15	Submit a title for your project with a short description of the subject and the intended extent of your work
10/13	Submit an abstract, headings for the subjects and a list of references.
11/17	Two copies of the completed term projects are due and are exchanged with other students for review.
11/24	Review submittal
12/01	Project presentations

The project grade will reflect the intermediate steps, the soundness of the study, the writing, and the presentation.

General Ideas for Possible Projects:

Computer Programs

1. Simulation of shallow foundation load test
2. Static capacity of shallow foundations
3. Sheet pile wall analysis (cantilever and/or anchored)
4. Interpretation of a shallow foundation load test
5. Beam on elastic foundations
6. Shallow foundation settlement analysis (immediate and/or time dependent)

Others:

1. Drainage problems; foundations or retaining structures.
2. Shear strength parameters including interface friction.
3. Dewatering and/or braced excavations.
4. Field instrumentation following the structure's performance.
5. Frost problems; foundations or retaining walls.
6. Mat foundations/ floating structures
7. Lateral resistance of shallow foundations.
8. In-situ testing/Interpretation methods.
9. Comparisons of load test interpretation methods
10. Mechanically stabilized Earth Walls.
11. Lightweight artificial and waste materials for embankments over soft soils.
12. LRFD of industrial or highway substructures.
13. Comparison between calculated to measured capacity or settlement of shallow foundation.
14. Bridge pier or abutment design.