

CEE 6443 Syllabus - Fall 2019

Geotechnical Foundation Systems: Section A, and 3.0 Credits

Tuesdays & Thursdays, 09:30-10:45 a.m., Location: Mason Building: Room 3132

Instructor Information

Instructor

Paul W. Mayne, PhD, P.E.

Email

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Office Hours & Location

Tues & Thurs 08:00-09:15 a.m.

Tues & Thurs 11-12 noon*

or by appointment

Office: Mason 2245

In-Situ Lab: Mason 2268

*Note: sometimes this may conflict
with CEE faculty meetings

General Information

Website: <http://geosystems.ce.gatech.edu/Faculty/Mayne/Research/index.html>

Description

Civil engineering projects are constructed on the ground which is composed of natural geomaterials, primarily soils and rocks, as well as compacted fills and reinforced earth. Structural loading from buildings, bridges, towers, dams, roadways, and offshore platforms must be conveyed into the underlying geologic formations and withstand sufficient bearing capacity and tolerable displacements. This course covers both theoretical and practical aspects on the following: (a) review of soil behavior from the laboratory point of view; (b) site characterization by in-situ field testing and geophysics; (c) shallow foundations; (d) driven piling foundations, augering piles, and drilled shafts; and (e) an introduction to ground modification techniques. Concepts of critical state soil mechanics (CSSM), static equilibrium, limit plasticity, elasticity solutions, and cavity expansion theory are applied, with many case studies used as examples.

Pre- and Co-Requisites

There are no formal pre-requisites for this graduate course, yet the student is expected to have taken some background in soil mechanics, such as introduction to geotechnical engineering per a BSCE background.

Course Goals and Learning Outcomes

The student will learn to appreciate the various site investigative tools that are necessary for geotechnical site characterization, including laboratory tests and field methods such as drilling, sampling, in-situ probes, and geophysics. The information derived from these methods will help make the optimal selection of a set of possible solutions for supporting civil engineering structures, including foundation systems and/or ground modification.

Course Requirements & Grading

Depending upon enrollment and students' backgrounds and enthusiasm, the instructor, TA, and class participants may elect to change the below scoring and weighting to best reflect the success of learned lessons. Standard grading includes: A: 90-100%; B: 80-90%, etc. applies, although historically Dr. Mayne has curved the scores (upward) following a midterm exam, pop quiz, and/or final, depending specifically on the performance of the class.

Assignment	Date	Weight (Percentage)*
Homeworks (usually 6 to 8)	Various	20%
In-Class Exercises (Groups)	Various	5%
Midterms (2)	approx. week 6 and approx. week 11, but varies	25% 25%
Final	See last page	25%

*Tentative based on actual semester scheduled meetings, weather, GT closures, conferences, special events, faculty meetings, and/or other factors, such as at the discretion of the Instructor and/or GTA.

Extra Credit Opportunities

Normally, no extra credit problems or assignments are given, unless special circumstances occur

Description of Graded Components

Homeworks usually involve calculations made using computer software, mainly Excel spreadsheets, although some students use MathCad, MatLab, or other. Please use the graphics capabilities of these programs so that a nice professional presentation of the data and results are available. If your set of data and calculations goes beyond a single page, make sure to annotate (either by computer text or hand-written) the names of the various columns and legends. Always show units (SI units preferred) and titles of information. In most geotechnical calculations, answers with up to two or three decimal places will be sufficient. Answers with up to 10 or more decimal places are not practical. Use of color and special symbols (σ_v' , ϕ' , γ_t , etc.) are encouraged for geotechnical nomenclature.

Grading Scale

Your final grade will be assigned as a letter grade according to the following scale:

A	90-100%
B	80-89%
C	70-79%
D	60-69%
F	0-59%

Despite the grading scale given above, it has been common to curve the entire class grades based on overall performance in the homeworks, midterms, and final grade.

Course Materials

Course Text

Course reading materials will be provided in the form of PDF notes of the lectures and other related materials posted at Canvas

1.0 CEE 6443 NOTES: Geotechnical Foundation Systems by P.W. Mayne (2019)

These notes plus class lectures will be supplemented with design manuals, technical documents, and selected papers that are assigned by the Instructor, for instance:

2.0 NCHRP 258: Manual on Subsurface Investigation (Rix, Mayne, et al. 2019)

<http://www.trb.org/main/blurbs/178722.aspx>

3.0 NCHRP Synthesis 368 on Cone Penetration Testing (Mayne 2007)

<http://www.trb.org/main/blurbs/159351.aspx>

In addition, National Highway Institute Manual on Geotechnical Site Characterization (NHI) by Mayne, et al. (2002) and FHWA GEC 5 - Evaluation of Soil & Rock (Sabatini et al. 2005) are posted online at:

<http://geosystems.ce.gatech.edu/Faculty/Mayne/papers/index.html>

There are no required purchased textbooks for this course.

Some additional recommended references include:

Poulos & Davis (1974). Elastic Solutions for Soil & Rock Materials, Wiley & Sons, NY

which is available as a free PDF download from: www.usucger.org

Course Website and Other Classroom Management Tools

We usually post notices, homework assignments, and some ancillary technical documents on Canvas for download by the class attendees.

Course Expectations & Guidelines

Please follow the best practices for teaching and learning at [Georgia Tech policies and procedures](#).

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Georgia Tech's Academic Honor Code, please visit

<http://www.catalog.gatech.edu/policies/honor-code/>

<http://www.catalog.gatech.edu/rules/18/>

Any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at (404)894-2563 or <http://disabilityservices.gatech.edu/>

Attendance and/or Participation

The university requires that the Instructor report when each of the students last took classes, at set established deadlines during the semester term (usually during the first two weeks, and then again at final exam periods). While it is not mandatory to attend all classes, periodic sign-in sheets will be circulated during class so that the Instructor has some record as to who has attended or not, for reporting purposes.

Collaboration & Group Work

Students are expected to complete their own homework assignments in order to gain full credit on each task. Collaboration on overall strategies and procedures is permissible. However, copying the same spreadsheet and merely changing one's name on the document is not valid.

Homework assignments should be printed out hard-copy and submitted to the Instructor or TA on the assigned due date. In most cases, an extra day or two for late homeworks submission is fine.

Extensions, Late Assignments, & Re-Scheduled/Missed Exams

If a student must be excused from a midterm or final examination, please try and coordinate with the

Instructor or TA as soon as possible for a make up test.

Homeworks are not usually accepted late if the solution has already been posted on-line (T-square).

Student-Faculty Expectations Agreement

At Georgia Tech we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and students, as detailed:

<http://www.catalog.gatech.edu/rules/22/>

A simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

Student Use of Mobile Devices in the Classroom

Smart phones, computers, and tablets are permitted in the classrooms during lectures, in-class assignments, and/or demonstration sessions. The use of texting, internet, emails, etc. are all allowed during class. However, voice messages, two-way video (e.g. FaceTime), and talking must be reserved for outside of the classroom for courtesy reasons unless it is part of course discussion and questions & answer time.

During exams, only the use of pencil or pen, paper, rulers, and hand-held calculators, abacus, and slide-rulers are allowed. No smart phones, texting, computers, tablets, or internet are permitted at that time.

Additional Course Policies - Food & Drink

Food and drink within reasonable quantities are okay in the classroom, excepting alcoholic beverages, edible cannabis, psychedelic mushrooms, and poisonous foods. No smoking is permitted.

Campus Resources for Students

Additional resources for GT students include: the Gilbert Price Library, The Communication Center, The Center for Academic Success, Counseling Center, The Division of Student Life, and Women's Resource Center.

Course Schedule* - CEE 6443 - Geotech Foundations - Fall 2019

A tentative agenda is given for the various topics of the course on the last page. It is difficult to predict the exact amount of time each module and section will take, since class size, participatory activities, school closures due to weather, illness, etc. may affect the actual schedule. Therefore, Dr. Mayne has provided an approximate agenda based on the 17-week semester calendar.

Please remember these important dates:

- Monday, August 19: First day of classes
- Monday, Sept 30: Progress report Grades due for 1000 and 2000-level classes
- Mon & Tues, Oct 14-15: No classes, Fall Break
- Saturday, Oct 26: Drop Day
- Wednesday - Friday, Nov 27-29: Thanksgiving break (no classes on Wednesday)
- Dec. 2 and 3: Final Instruction Days
- Dec. 4, 5, 10: Reading Period until 2:20pm on Dec. 5 and 10
- Dec. 5 - 12: Final Exams. **The Final Exam for CEE 6443 Geotech Foundations is scheduled for Monday 9th December 2019 from 11:20 am to 2:10 pm**
- Monday, Dec 16: All grades due by noon

CEE 6443 - Geotech Foundations - Tentative Agenda & Schedule for Fall 2019

<i>Tuesday Class Date</i>	<i>Thursday Class Date</i>	<i>Remarks</i>
Week 1: Introduction; units, Review: soil classification, soil mechanics, Critical-State Soil Mechanics (CSSM)	Overburden stresses; overconsolidation and stress history Foundation Bearing Capacity (BC)	Hmk 1 - Consol
Week 2: Limit plasticity solutions	Applications of BC to case studies	Hmk 2 - CSSM
Week 3: Geophysics and nondestructive testing	Possible Field demonstration of geophysics or in-situ testing	Sept 4 Labor Day Holiday ECSMGE, Reykjavik
Week 4: Subsurface investigations	Geotechnical site characterization	
Week 5 Soil borings, augering, rock coring, field investigations	In-Situ Testing, cone penetration, flat plate dilatometer	Hmk 3
Week 6: Geoparameter evaluation and interpretation by in-situ tests	Bearing capacity of foundations using in-situ field data	Hmk 4
Week 7: Rock classification, RMR, Q-rating; Foundations on Fractured Rocks	MIDTERM 1* (tentative)	
Week 8: Fall Recess (no class)	Foundation displacements; influence factors	Fall Recess
Week 9: Elastic continuum solutions; Stress distributions beneath surface	Foundation settlement calculations; Case studies	Hmk 5
Week 10: Deep foundation systems: Driven Piles; Drilled & Augered shafts	Axial pile capacity; pile types & installation	Hmk 6
Week 11: Pile side resistance; end bearing; load transfer distributions	Applications & case studies on deep foundations	
Week 12: Pile displacements using elastic continuum solutions	MIDTERM 2* (tentative)	
Week 13: ADSC-ASCE-FHWA Load Test at GT Campus; O-cell tests at Clough Center	Approx. nonlinear pile response; Direct in-situ methods for piling and deep foundations	Hmk 7
Week 14: Pile groups; pile supported rafts	<i>Thanksgiving (holiday) - no class</i>	Thanksgiving holidays
Week 15: Lateral and moment pile capacity and response	Advances: Statnamics; O-Cell; Integrity Testing; Press-in-piling	
Week 16: Ground modification and site improvement methods	Reading period	Final Classes
Week 17: Final Exam	Mon. Dec 09 11:20 AM - 2:10 PM	

*Tentative based on weather, GT closures, conferences, special events, faculty or committee meetings, and/or other factors, such as the discretion of the Instructor and/or GTA.