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Spring 2022

CE 341A-002: Soil Mechanics Lab

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Baptista Pereira, Catarina, "CE 341A-002: Soil Mechanics Lab" (2022). *Civil and Environmental Engineering Syllabi*. 585.
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NEW JERSEY INSTITUTE OF TECHNOLOGY

CIVIL AND ENVIRONMENTAL ENGINEERING DEPARTMENT

CE 341A - Soil Mechanics Laboratory (face-to-face mode course) **Spring 2022**

Text: Das, Braja, Soil Mechanics Laboratory Manual, **9th Edition**, Oxford University Press, ISBN: 9780190209667

Instructors: Ms. Baptista-Pereira, e-mail – cb373@njit.edu (https://njit.webex.com/meet/cb373)

Office hours Schedule with TA/Professor/Instructor (in person or via Webex).

Corequisite: CE 341. Students perform basic experiments in soil mechanics

Course Objectives

1. Learn index properties of soils and laboratory methods of soil classification,
2. Learn Compaction and hydraulic conductivity tests
3. Learn principles of Consolidation and shear strength and
4. Learn to design and analyze a custom experiment

Course Outline

Class #	Lab Experiment*	Assignments		Chapter
Class 1	Orientation	No assignment		Notes
Class 2a	Sieve Analysis	Introduction	Report 1	4
Class 2b	Hydrometer Analysis	Introduction		5
Class 2c	Atterberg Limits (Liquid limit test, percussion cup method, and Plastic limit test)	Introduction		6,8
Class 3a	Determination of Field unit weight of compaction by Sand Cone Method	Introduction	Report 2	11
Class 3b	Standard Proctor Compaction test	Introduction	Report 3	10
Class 4	Constant-head Permeability Test in Sand	Introduction	Report 4	13
Class 5	Custom Design Experiment (midterm report)	Introduction	Report 5	Handout
Class 6a	Consolidation Test	Introduction	Report 6	17
Class 6b	Consolidation Test Calculations			17
Class 6c	Consolidation Test Write Up			17
Class 7a	Unconfined Compression Test	Introduction	Report 7	16
Class 7b	Direct Shear Test on Sand	No assignment		15
To be scheduled	**Missed Laboratory** Report	Please see the lab information		-

* Some modifications to schedule may be required to ensure that the laboratory sessions follow the lectures/NJIT's Calendar:

"*Prior to the start of this semester, please read through the NJIT Guidance for Transitioning to Remote Instruction page and register for the Campus Wide Notification System. In the event that NJIT transitions to remote instruction, I will share course-specific delivery information with students via email and through the Canvas Announcement tool. It is recommended that students have their notifications turned ON for Canvas Announcements. If you do not have adequate computing equipment for remote instruction, please contact the Dean of Students (dos@njit.edu).*"

# Indicates the experiment number in the laboratory manual (**9th Edition**).

The students have **1 (one) missed laboratory Report** that they can deliver during the last week of classes without the Professor/TA/instructor needing an email from the Dean of Students Office (excusing the students from attending the class). Assignments named as "Introduction" do not count as missed "Report". If the students attend the laboratory session, it is expected they deliver a report. If a report is not delivered, that report will not count as a missed report, and it will count for the final grade (graded as zero). There are no make-up reports. The outlines/data of "missed laboratory" Reports might change. The Custom design experiment (midterm report) cannot be delivered as a missed report.

Policies and Instructions

1. Attendance is mandatory and students must be in the room/WebEx on time (The Professor/TA/instructor will call by each name of the students during each session).
2. Official documents regarding missing classes must be submitted to the Dean of Students and Campus Life Office to be subjected of approval. The Professor/TA/instructor does not review those documents.
3. If the instructor sees any wrong behavior, all involved students will be asked to leave the class and the report will be graded as zero.
4. Please read the laboratory manual and the handouts, if provided (NJIT online system), before coming to class.
5. Individual Reports. Each member will hand in an individual laboratory report that reflects their individual analysis and commentaries. Group reports are not allowed.
6. The reports are always uploaded on the system used by NJIT by the students. If online system is not working, an email must be sent to the Professor/TA/instructor regarding this issue; however, the report must be sent by email on time. If not delivered on time: 1 day late: 25% deduction, 2 days late: 50% deduction; 3 days late and following days: 100% deduction.
7. Emails must include in the subject: [CE 341A] – "main purpose of the email".
8. If any modifications or deviations from the syllabus throughout the semester are made, the students will be notified through the online system.
9. The NJIT Laboratory General Lab Safety Guidelines apply to this course. Please see guidelines outside the Soil Mechanics lab (Colton 314 – Geotechnical Teaching Laboratory)

General Procedure

10. In order to keep work benches clean spread newspaper on the workbench and floor when necessary.
11. Each student/group will be responsible for the equipment he/she will be using. Please make sure that the equipment is in proper working condition prior to and after completion of the experiment.
12. Students must clean and/or wash assigned equipment and place all the equipment and accessories at the proper locations (cabinets have been labeled) at the conclusion of their experiment. Before leaving, you must check with TA so that he/she/them can inspect your work area. Not following this guideline will result in a penalty in the report grade (starting at 10 points).
13. After the completion of an experiment, complete as much of the computation as possible (including name of group members and date), and have the instructor sign the data sheets before leaving. These sheets (original) must be attached to the laboratory report. Reports that do not include signed data sheets will not be graded.
14. Remove water content containers from the oven within 48 hours. Otherwise, they will be discarded.
15. Keep wet samples in cans covered with lids until they have been weighed.
16. For drying, place the cans in a tray, making sure the lids are under the cans and not on top of them. Place a slip of paper in the tray. Write on the slip, the laboratory section number, date, and group number. Do not write on cans or lids. Alternatively, record the full name written in the cans.
17. Be observant - if you see something that does not look right, do not continue with the test and consult the instructor. For example, while mixing soil with water, if you see some dark and light-colored soil lumps, this means that the mixing has not been done properly.
18. No food and drinks inside the laboratory.
19. Proper attire must be worn while in the laboratory. No open toed shoes, short pants, or skirts, etc. Students without proper attire will not be allowed to be inside the laboratory room and will not be able to perform the experiment (Report and Punctuality will be graded as zero)
20. No pranks, practical jokes or fooling around.
21. If the instructor sees any wrong behavior (including the previous points), all involved students will be asked to leave the lab and the **Report** will not be graded and **Punctuality** will be graded as zero.

Format and Basis of Grading of Laboratory Reports

Introduction[1]	10%
Punctuality[2]	15%
Cover Page[3]	5%
Sample Calculations[4]	10%
Results including graphs and tables[5]	20%
Discussion[6]	20%
Summary and Conclusions[7]	10%
References[8]	2%
Quality of Presentation, graphs, tables etc.	8%
Total	100%

The Assignments must be typed. No double space, font Arial or similar and size 10, justified. Please follow the order of the chapters given in the previous table, as it will counts towards the presentation score.

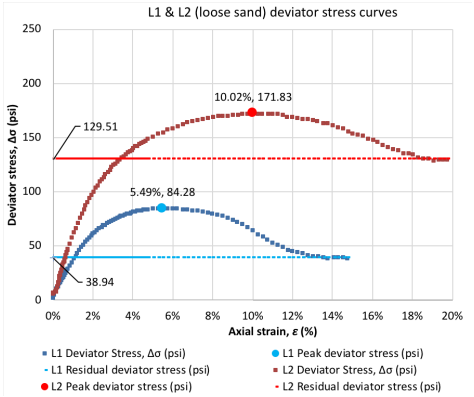
Each "Lab Experiment" will have a maximum grade of 100 points (Orientation class and Direct Shear test do not count for final grade). The course grading is based on:

- **Introduction assignment** (10% of the grade),
- **Punctuality** (15% of the grade) and
- **Written document** (Report) (75% of the grade).
- The grades are formatted with 2 decimals.

overall	min	max
F	0.00	49.99
D	50.00	59.99
C	60.00	64.99
C+	65.00	69.99
B	70.00	79.99
B+	80.00	84.99
A	85.00	100.00

Footnotes:

1. The **Introduction Assignment** (1/2 to 1 page) must be written **in your own words (even the procedure)**. References are mandatory, if students use information that was not developed by them (please include the lab manual). The Introduction assignment must be delivered before each class. No partial grade is given if Introduction Assignment is delivered late. In this document, students need to include the information that can answer the following questions:
   a. **Standard number**: what is the standard number that is used for this experiment (2 points)
   b. **Importance and Purpose**: Why we need to perform the experiment (purpose of experiment)? (2 points)
   c. Procedure: How do we run the experiment, in terms of steps performed? What equipment needs to be used (2 points)
   d. **Outcome and Results:** What kind of results you expect to obtain and how to get them? (3 points)
   e. **References**: all references you used to write the document must be in the document (0.5 points)
   f. **Presentation**: The document must be presented in an organized and in a neat way (0.5 points)
2. **Punctuality** will be taken any time after 5 minutes of starting of class. If students are not on time and if the name of students is called but they do not reply/sign their names, Punctuality will be graded as zero. After 30 minutes of the beginning of the class, late students will not be allowed to perform the experiment, the Punctuality points will be deducted, and the report will be graded zero.
3. The **Cover page** must contain title, the name of student, course number and section, date of the class(es) and deadline of report, group members.
4. Show one **sample calculation** (formulas and values used), similar to that shown in the manual, for each experiment. If you need to use any values of tables/graphs/etc., an explanation must be included. If you use symbols, they must have a label (e.g. "*e*" is the void ratio).
5. **Results** should include the completed data sheets, tabulated results and/or graphs, and computer output sheets (when applicable). Tables and graphs must have captions and must be well labeled (titles, units, points of interest, tangents, etc.).



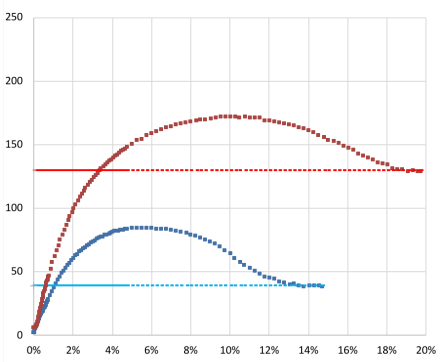


Figure 1: Deviator stress curves for sample 1 and 2

Correct: units, labels, points of interest, title, etc.

Wrong: missing all important information

Correct table

Table 1: Results obtained per type of sample

ID	Void ratio (-)	Relative density Dr (%)	Confining pressure σ3 (psi)	Deviator stress Δσ (psi)	Peak stresses ratio σ1/σ3 (-)	Vol. strain ΔV/V (%)	Axial strain ε (%)

Wrong table

ID	e	Dr	σ3	Δσ	σ1/σ3	ΔV/V	ε

6. In the "**Discussion chapter**" comment on the accuracy of your results and compare your results with those of others, in identifying your sample of soil and its properties (do **not** compare your results with other students – you **must** compare your results with scientific articles, journals, books, websites, class notes, etc.).

Comment on deviations from the prescribed procedure (do not write the procedure), limitations of equipment, and explanation of sources of error, and how all of these affect (or not) the results. (1 to 2 pages). Specific questions might be asked during the classes that need to be answered accordingly in this chapter. When commenting and/or discussing, the final results must be explained why and how they were achieved.

7. In "**Conclusion chapter**", the students must write a brief summary of the laboratory exercise (1 paragraph). The students need to include all final conclusions (values and points of interest that were analyzed in the discussion chapter, type of soil, etc.) (1 paragraph).
8. **References** if any shall be provided in standard ASCE format (see ASCE citation style guide[1]). In the "References chapter", the detailed information of each reference used must be included: if information is used from any website/book/lecture notes/etc., but the credits are not given to the author (in the Report and Introduction assignments), points will be deducted from the report's final grade. There are two types of copying:
    - Direct copying – when information is directly copied without changing author's words. Quoting symbols ("XXX") and references must be used
    - Indirect copying – when information is rewritten in students' own words. References must be used: e.g. - According to Bareither et al. (2008), it is believed…
9. **Students are not allowed to copy and paste information that it was not developed by them**. Students cannot, as well, share their reports to other students, allowing other students to copy from them. Students can change ideas between them in order to write their reports and to improve their social skills and knowledge. However, the students are not allowed to share information that was developed by them, namely reports, excel documents, graphs, tables, equations, formulas, etc.

"Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at: http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf.

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. ***Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university.*** *If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu"*

In Short:

- Online submission of reports to obtain a grade.
- Individual reports. However, each student will be a member of a team.
- Reports must be written in proper English and with the scientific names learned in classes. If not, points can be deducted.
- Assignments will be due at the date mentioned by Professor/TA/Instructor (please see the online submission tab at the online system to know the exact hour and date).
- The reports must be uploaded on the online system of NJIT. The Professor/TA/instructor will note the date and the time of submission. Reports by email are not acceptable, except if the online system is not working properly (keep in mind that the reports sent by email still need to be send on time for students to not lose any points).
- Late Assignments: Late "introduction" assignments will be graded zero; Late "report" assignments will have a late penalty (if delivered more than 2 days late, it will be graded zero).
- If the students are late, the **Punctuality** points will be deducted. After 30 minutes, the students will not be allowed to perform the experiment, **Punctuality** and **Report** will be scored zero.
- **(In)direct copied** reports will be score **as zero**.

[1] https://www.canterbury.ac.nz/library/support/citations-and-referencing/asce-citation-style/

Outcomes Course Matrix – CE 341A Soil Mechanics Laboratory

Strategies, Actions and Assignments	ABET Student Outcomes (1-7)	Program Educational Objectives	Assessment Measures
Student Learning Outcome 1: Test and analyze the properties of soil.			
Show different test equipment used to measure engineering properties of soils.	1	1	Attendance, class participation.
Measure engineering properties of soils using different test equipment.	1	1	Attendance, class participation.
Interpret the test data to obtain engineering properties of soils.	1	1	Attendance, class participation.
Present the test results in the form of a laboratory report.	3	1, 2	Final report
Student Learning Outcome 2: Determine ranges of numerical values expected from soil tests.			
Interpret the test data to obtain engineering properties of soil.	6	1	Attendance, class participation.
Compare the calculated results with typical soil data.	6	1	Final report
Present the test results in the form of a lab report	3	1, 2	Final report
Student Learning Outcome 3: Recognize how to use those properties in geotechnical designs.			
Compare the calculated results with typical soil data.	1	1	Final report.
Present the test results in the form of a laboratory report.	3	1, 2	Final report.
Student Learning Outcome 4: Design and complete a custom experiment, analyze data and draw conclusions.			
Based on the experience gained, plan a set of tests that will yield answers to the problem at hand.	3, 6	1	Verbally presenting their approach and solution to the instructor and final report.

CEE Mission, Program Educational Objectives and Student Outcomes

The mission of the Department of Civil and Environmental Engineering is:

1. to educate a diverse student body to be employed in the engineering profession
2. to encourage research and scholarship among our faculty and students
3. to promote service to the engineering profession and society

Our program educational objectives are reflected in the achievements of our recent alumni:

1 – Engineering Practice: Alumni will successfully engage in the practice of civil engineering within industry, government, and private practice, working toward sustainable solutions in a wide array of technical specialties including construction, environmental, geotechnical, structural, transportation, and water resources.

2 – Professional Growth: Alumni will advance their skills through professional growth and development activities such as graduate study in engineering, research and development, professional registration and continuing education; some graduates will transition into other professional fields such as business and law through further education.

3 – Service: Alumni will perform service to society and the engineering profession through membership and participation in professional societies, government, educational institutions, civic organizations, charitable giving and other humanitarian endeavors.

Our Student Outcomes are what students are expected to know and be able to do by the time of their graduation:

1. an ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare, as well as global, cultural, social, environmental and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies