Spring 2019

CE 341A-102: Soil Mechanics Laboratory

Janitha Batagoda

NEW JERSEY INSTITUTE OF TECHNOLOGY

CIVIL AND ENVIRONMENTAL ENGINEERING DEPARTMENT

CE 341A - Soil Mechanics Laboratory (Room 314, Colton) Spring 2019

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

Instructor: Dr. Janitha H. Batagoda, e-mail: jh358@njit.edu, TA - Catarina Pereira, e-mail - cb373@njit.edu

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

Week	Experiment*	
1	Introduction/Orientation	Notes
2	Sieve Analysis	4
3	Hydrometer Analysis (combined report with sieve anal.)	5
4	Atterberg Limits	6,8
5	Field Compaction	11
6	Compaction	10
7	Constant Head Permeability Test	13
8	Custom Design Experiment	Handout
9	Consolidation Test	17
10	Consolidation Calculations	Handout
11	Consolidation Write Up	
12	Unconfined Compression Test	16
13	Direct Shear Test	15
14	Make up missed experiment	

* Some modifications to schedule may be required to ensure that the laboratory sessions follow the lectures.

# Indicates the experiment number in the laboratory manual.

Policies and Instructions

- ✓ Attendance is mandatory and students must be in the laboratory on time.
- ✓ Please read the laboratory manual and the handouts, if provided (moodle), before coming to class.
- ✓ Hand in report to the T/A as you come into class (at the beginning of the class).
- ✓ Use only data sheets provided in the manual to record data. ABSOLUTELY NO SCRAP PAPER. If you do not have data sheets for a test please notify the Instructor.
- ✓ If unsafe conditions are present do not continue work until safe working conditions are restored.
- ✓ If you need equipment or tools, ask the TA or the instructor. Do not help yourself to other equipment in the laboratory. Do not borrow any equipment from other groups.
- ✓ If your assigned equipment is not functioning properly, please bring this to the attention of the Instructor/TA.
- ✓ Participation in conducting the experiment is required for the laboratory. It will count towards the grade as shown in the basis of grading section.
- ✓ The class will be divided into groups for conducting laboratory experiments.
- ✓ Individual Reports. Each group member will hand in an individual laboratory report that reflects their individual analysis and commentary. No group reports.

General Procedure

1. In order to keep work benches clean **spread newspaper on the workbench and floor** when necessary.
2. 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.
3. 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 can inspect your work area. Not following this guideline will result in a penalty in the report grade (starting at 10 points).
4. 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.
5. Remove water content containers from the oven within 48 hours. Otherwise they will be discarded.
6. Keep wet samples in cans covered with lids until they have been weighed.
7. 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.
8. 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.
9. No food and drinks inside the laboratory.
10. Proper attire must be worn while in the laboratory. No open toed shoes, short pants or skirts, etc.
11. No horseplay.

Using a Balance

1. Check the capacity of an electronic balance before using it. Never load a balance beyond its posted capacity.
2. Perform the zero correction before weighing.
3. Use the same balance for weighing during an experiment.
4. For water content determination, use a balance that has an accuracy of 1/100 of a gram (0.01).
5. For samples weighing between 200g and 2000g, use a balance that has an accuracy of 1/10 of a gram (0.1).
6. For samples weighing more than 2000g, use a balance with an accuracy of 1 to 5 gm

Format and Basis of Grading of Laboratory Reports

Pretest Summary and Attendance[1]	15%
Title Page[2]	5%
Introuduction[3]	10%
Sample Calculations[4]	10%
Results including graphs and tables[5]	20%
Discussion[6]	20%
Summary and Conclusions[7]	10%
References[8]	0%
Quality of Presentation, graphs, tables etc.	10%
Total	100%

Footnotes:

1. Pretest summary should include the information that can answer the following questions: why run the test? How to run it? What kinds of results are expected and how to get them (principles of the test should also be briefly summarized). Pretest summary should be written **in your own words**. Attendance will be taken 5 minutes after class starts. (1/2 to 1 page).
2. The title sheet should contain title, the full names of the members of the group who were present during the lab exercise, course number and section, date of the experiment, date of report, team number and team logo. The report should be typed and bind on the left hand side.
3. In the introduction, the aim and the main procedure (not full procedure) of the test should be summarized. Additionally, different types of soils and the equipment used should be clearly stated, and an example of a practical application of the experiment. State the relevant ASTM and AASHTO standards for the test. (1/2 to 1 page).
4. Show one sample calculation, similar to that shown in the manual, for each experiment.
5. Results should include the completed observation sheets (with instructor's signature), tabulated results and/or graphs, and computer output sheets (when applicable).
6. In the Discussion comment on the accuracy of your results and compare your results with those of others (not those of your class) in identifying your sample of soil and its properties. Comment on deviations from the prescribed procedure (do not write the entire procedure), limitations of equipment, and explanation of sources of error, and how all of these affect (or not) the results. State the relevant ASTM and AASHTO standards for the test. (1 to 2 pages).
7. A brief summary of your laboratory exercise is to be provided. Include conclusions. (1/2 to 1 page).
8. References if any shall be provided in standard ASCE format.

In Short:

- Perform all tests and submit completed reports to obtain a grade.
- Individual reports.
- Test reports will be due at the start of the next laboratory period.
- Late reports will be subjected to a penalty of 25% per day.
- Each report will be 100 points.

CE 341 A — Soil Mechanics Laboratory

Description:

The students perform basic experiments in soil mechanics and design and carry out tests to solve a specific problem.

Prerequisites: Mech 237 - Strength Of Materials **Co requisite**: CE 341 – Soil Mechanics

Textbook(s)/ Materials Required:

Das, B.M., Principals of Geotechnical Engineering

Course Objectives:

l. Learn how to measure the basic properties of soils.
2 Learn how to determine typical ranges of numerical values expected from those tests.
3. Learn how to use those properties in Geotechnical designs.
4. Design and complete a custom experiment.

Topics:

Sieve analysis
Hydrometer analysis
Atterberg limits
Visual soil classification
Compaction test
Sand cone test (Filed compaction)
Permeability
Design and complete an experiment to solve a given engineering problem
Consolidation test
Direct Shear Test
Unconfined Compression Test

Schedule: (0-3-1)

Professional Component: Engineering Topics
Program Objectives Addressed: 1, 2

Prepared By: Prof. Khera **Date:** 9/21/06

Outcomes Course Matrix – CE341A 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:

- to educate a diverse student body to be employed in the engineering profession
- to encourage research and scholarship among our faculty and students
- 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

Revised: 2/13/18