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Benchmark Portfolio: CIVE 334 - Introduction to Geotechnical Engineering

Seunghee Kim
University of Nebraska-Lincoln, seunghee.kim@unl.edu

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A Junior-level mandatory course in the Department of Civil Engineering

Seunghee Kim
Assistant Professor, Department of Civil Engineering
University of Nebraska-Lincoln
Email: seunghee.kim@unl.edu

Course: CIVE 334 – Introduction to Geotechnical Engineering

Abstract
This Benchmark Portfolio is for CIVE 334 "Introduction to Geotechnical Engineering". The course description is provided as "soil composition, structure and phase relationships; soil classification; principles of effective stress; loading induced subsurface stresses; load history; deformation and failure of soils; elastic and limit analysis with applications to design for bearing capacity, settlement, retaining walls, and slope stability; steady-state seepage." This course is mandatory for students in the department of civil engineering, and the only mandatory class in the sub-discipline of geotechnical engineering. Therefore, this course is critical for students to have foundational knowledge about soil mechanics and geotechnical engineering, and essential to understanding other advanced topics in the sub-discipline of geotechnical engineering. After successfully passing this course, the instructor wants that students become capable of the following aspects: (1) understand soils as an important construction material; (2) understand how soils can be categorized into different groups (*e.g.*, fine-grained and course-grained soils) based on their index and physical properties; (3) understand the hydraulic properties of soils in relevance to their classification; (4) understand the mechanical behavior of soils (deformation, stiffness, and strength) with their classification and presence of water; and (5) apply mathematical formulae to predict such a hydraulic-and-mechanical response of soil materials. Main purpose of this benchmark portfolio is to examine how students achieve these key learning objectives and look for possible improvements. The benchmark portfolio consists of benchmark memo 1, 2, and 3, followed by summary and reflection.

Keywords: course portfolio, backward design, midterm feedback, data driven classroom, geotechnical engineering

1. Introduction

This Benchmark Portfolio is for CIVE 334 "Introduction to Geotechnical Engineering". This course is a mandatory course for all students in the Department of Civil Engineering. It is the first time for the instructor to teach this course at the Omaha campus. The main purpose of this benchmark portfolio is to examine how students achieve the key learning objectives of this course and look for possible improvements. The benchmark portfolio consists of benchmark memo 1, 2, and 3, followed by summary and reflection.

2. Benchmark Memo 1

What is your course?

The course is CIVE 334 "Introduction to Geotechnical Engineering" that has a parallel lab section. Its prerequisite is MECH 373 "Mechanics of Elastic Bodies", and is parallel with CIVE 310 "Fluid Mechanics". The course description is provided as "Soil composition, structure and phase relationships; soil classification. Principles of effective stress; loading induced subsurface stresses; load history; deformation and failure of soils. Elastic and limit analysis with applications to design for bearing capacity, settlement, retaining walls, and slope stability. Steady-state seepage." at the CIVE website (https://bulletin.unl.edu/courses/CIVE/). This course is mandatory for students in the department of civil engineering, and the only mandatory class in the sub-discipline of geotechnical engineering. For instance, other 400-level courses, such as "CIVE 434/834 Soil Mechanics II" and "CIVE 436/836 Foundation Engineering" are elective courses that have "CIVE 334 Introduction to Geotechnical Engineering" as a prerequisite. Mostly, junior-level undergraduate students take this course. Students usually take basic mathematics and science classes, along with basic introductory courses in the theme of civil engineering, and has no previous knowledge/experience with the soil mechanics. Therefore, this course is critical for students to have foundational knowledge about soil mechanics and geotechnical engineering, and essential to understanding other advanced topics in the sub-discipline of geotechnical engineering. This course contributes to achieving program outcomes defined by ABET such as:

[a] an ability to apply knowledge of mathematics, science, and engineering
[b] an ability to design and conduct experiments, as well as to analyze and interpret data
[e] an ability to identify, formulate, and solve engineering problems
[g] an ability to communicate effectively
[j] a knowledge of contemporary issues
[k] an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

What are goals for the course?

After successfully passing this course, the instructor wants that students become capable of the following aspects:

1) Understand soils as an important construction material.
2) Understand how soils can be categorized into different groups (*e.g.*, fine-grained and course-grained soils) based on their index and physical properties.
3) Understand the hydraulic properties of soils in relevance to their classification.
4) Understand the mechanical behavior of soils (deformation, stiffness, and strength) with their classification and presence of water.
5) Apply mathematical formulae to predict such a hydraulic-and-mechanical response of soil materials.

An additional goal is that students truly understand what geotechnical engineering is about, and appreciate the importance of it. In doing so, we wish that more students can consider geotechnical engineering as their major when they seek advanced degrees, such as master and Ph.D. degrees.

Why did you choose this particular course?
This course is mandatory, so every student who seeks a civil engineering major should take this course. Moreover, it is an only mandatory course in the sub-discipline of geotechnical engineering. In this regard, it is indeed critical to ensure the success of students' learning from this course so that students can move forward and successfully understand advanced topics in their senior year and graduate-level courses. Besides, this course has a parallel lab section, which is not necessarily well aligned with the course objective. Making students' learning visible in both lecture hours and lab sessions, therefore, will contribute tremendously to ensuring they understand geotechnical engineering at the moment of graduation.

Do you have any key goals that you want to accomplish by creating a course portfolio?
Based on personal experiences, it occurs quite often that many students do not understand what is geotechnical engineering about even after getting a passing grade of this introductory course. Even some students do not know what is an essential difference between fine-grained soils (*e.g.*, clays and silts) and course-grained soils (*e.g.*, sands and gravels). Thus, the key goal is that students feel that they can evaluate themselves as familiar with the topic of geotechnical engineering after completing the coursework. The benchmark portfolio will be used to refine the pedagogical approach to teach this course. It will also be used for the promotion and tenure package.

What sort of course portfolio would you like to create?
The resulting portfolio will provide a broad overview of the entire refined course that can facilitate the understanding of students on the subjects of general geotechnical engineering. It will also be used to refine quizzes, homework assignments, lab testing and reports, and exam problems to better evaluate students' performance with the course's objectives.

3. Benchmark Memo 2

What teaching methods are you using during your contact time with students?
The class generally proceeds with a lecture during most of each contact time. In detail, the previous lecture is briefly reviewed during the first five minutes so that students can be reminded of what was covered previously. After that, the key learning objectives for the day is introduced (or reiterated if the planned lecture is a continuation of the previous lecture). Then, the main lecture starts and continues until the class time is up. The instructor (that is, the author of this portfolio) attempts to interact with students by asking them questions whenever appropriate during the lecture. In general, more than 3-4 questions are asked by the instructor during the single lecture time.

What course activities outside of class are you using?
Activities outside of class are laboratory session and homework assignment. This course has a parallel three lab sessions of which every student is enrolled in among them. Every week, students do lab activities in a group that complement the corresponding week's learning contents. Each group consists of 4-5 students. After the lab activity, each group submits a lab report. In doing so, students have a chance to not only review the learning contents that were addressed in

each week but also actually apply the knowledge to a real case. In addition to the lab session, homework assignments are given at the end of every chapter of the textbook. The homework is assigned almost every week, and each homework assignment is expected to take about two hours to complete.

What course materials are you using?
The main course materials are textbook and lecture slides. The lecture slides are posted online (canvas) before class time so that students can download and take a look. In that way, students can anticipate what they will learn during each lecture time. And, the lecture slides have many blank lines and boxes that students need to fill in during the lecture time. In that way, they need to focus and make a note during class. The lecture slides are made based on the textbook contents, so students can review the learning contents by reading the filled-in lecture slides and textbook after the class.

What is the rationale for the methods you have chosen?
Quizzes and exams are the main tools to determine if students are meeting the goals of this course. This course has primary five goals that are specified in Benchmark Memo 1. Whenever each goal is covered during class, we did a quiz to see how students digest what they learn during class. If the outcome is not satisfactory, the instructor provides additional review of the contents before moving on to the next topic to ensure students' good learning experience. And, two midterm exams and one final exam serve as another tool to evaluate students' learning achievement. Moreover, we conducted a midterm and final survey to see how students themselves feel about their learning progress. In particular, the midterm survey provided valuable information with which the instructor modified the pace of the lecture and the proportion between the pure lecture part and problem-solving part so that students can understand better.

How do your course choices link to the broader curriculum?
This course is the foundational course upon which other advanced topics in the subdiscipline of geotechnical engineering can be taught. Therefore, it is critical that students have a good understanding of this course's learning contents so that they can do well other design-oriented courses in the 400-level.

4. Benchmark Memo 3
To assess the students' learning, the instructor used the following methods: pre- and post-quiz, general quiz after a thorough problem-solving time, midterm survey, quiz after the midterm survey, and final survey. Table 1 summarizes the teaching methods and utilized assessment mechanisms for each of the five learning objectives.
One particular aspect to notice is the classroom. To accommodate a large number of students (~75), the classroom shown in Figure 1 is used for this course. The problem is this classroom is not an ideal environment to promote the interactions between the instructor and students during class time. The abnormally wide classroom hinders the instructor from reaching students on both sides of the classroom. As shown in Figure 1, the location of the lecture podium sometimes renders the instructor to move mainly around the right-hand side of the classroom (from the students' perspective). Moreover, the level of interaction is different between different rows of the classroom. The instructor found that most students sit on the same spot throughout the whole

semester. In this regard, the instructor aims to examine the students' learning achievement between the two different sides (right *vs*. left) and between different rows (1st, 2nd, 3rd, and 4th row).

Table 1. Learning objectives, teaching methods, and assessment methods.

Learning objectives	Teaching methods/ Activities/Course activities	Mechanism used to evaluate student performance
Define soils as an important construction material	Lectures	
Characterize soils into different groups based on their index and physical properties	Lectures + problem-solving Lab sessions Homework	Pre- and post-quiz
Correlate hydraulic properties of soils in relevance with their classification	Lectures + problem-solving Lab sessions Homework	Quiz after problem-solving Midterm exam #1 Midterm student survey
Identify mechanical behavior of soils (deformation, stiffness, and strength) with their classification and presence of water	Lectures + problem-solving Lab sessions Homework	Midterm exam #2 Quiz after midterm survey
Apply mathematical formulae to analyze hydraulic-and-mechanical responses of soil materials	Lectures + problem-solving Lab sessions Homework	Final exam Final student survey

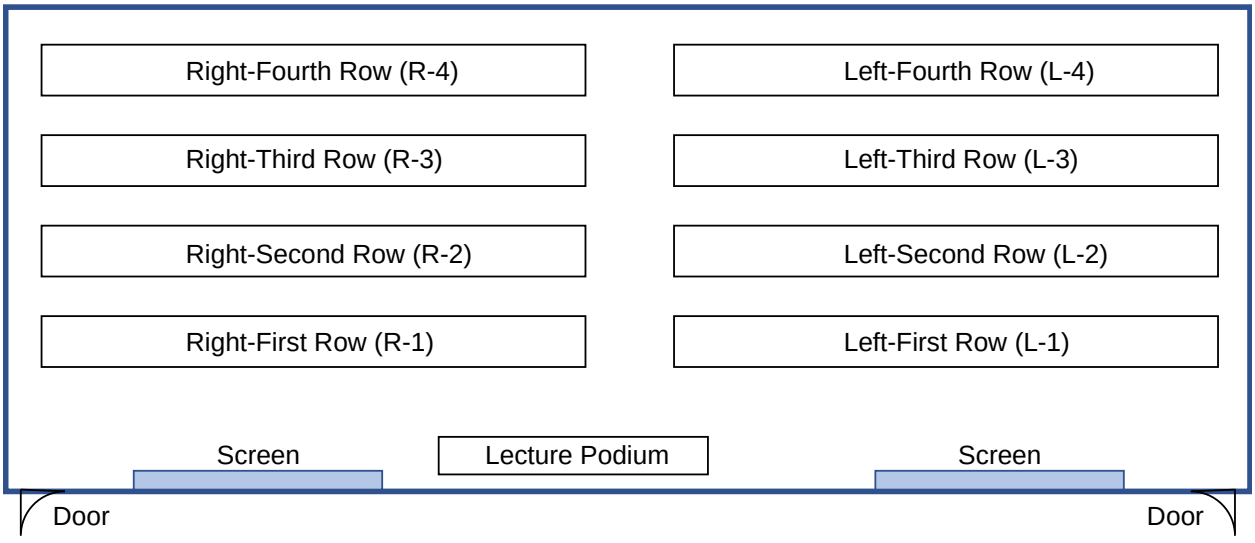


Figure 1. An illustration of the classroom used for this course.

4.1 Pre- and Post-Quiz (Quiz #1)

The first quiz was conducted to evaluate the achievement of second objective "Characterize soils into different groups based on their index and physical properties." Note that the first objective, "Define soils as an important construction material" is assessed at the end of the semester via the final student survey. The pre-quiz was conducted right after the topic is taught (lecture only), and the post-quiz was conducted after several problem-solving are presented to ensure the students' understanding of that objective. The pre- and post-quiz is shown in the appendix (they are an exactly same quiz). Figure 2 shows the scores of pre- and post-quizzes. Obviously, the score was greatly improved after going through several examples with students. It implies that problem-solving section helps students achieve a better understanding of a given subject. The average of post-quiz is around 90, which the instructor regards desirable. And interestingly, the average of students who sit on the right side of the classroom appears higher than that from the left side of the classroom.

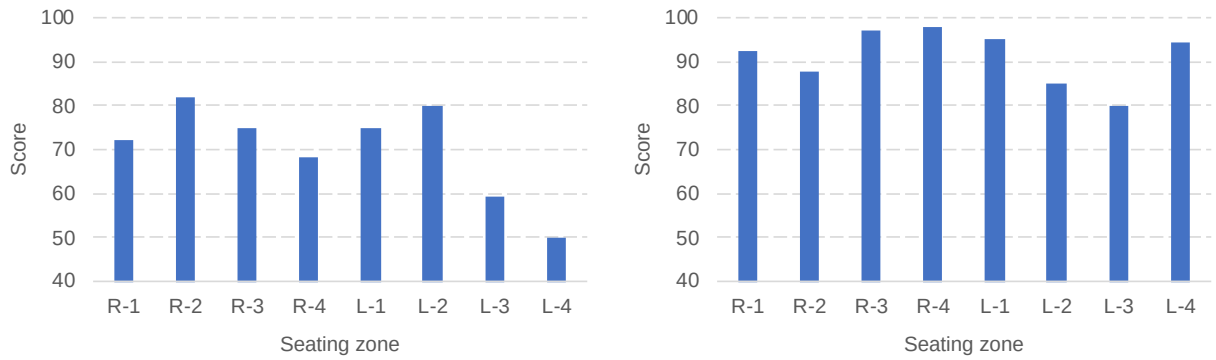


Figure 2. Average scores of pre-quiz (left) and post-quiz (right) about the second learning objective, "Characterize soils into different groups based on their index and physical properties."

4.2 Quiz #2

Quiz #2 was conducted to evaluate the achievement of third objective "Correlate hydraulic properties of soils in relevance with their classification." The instructor showed examples of solving problems before the quiz to ensure the students' learning. Quiz #2 is shown in the appendix. Figure 3 shows the score of quiz #2. A difference between the right and left side of the classroom was not apparent in this case. The scoring average is around 85-90, which is satisfactory. The instructor noted that the average score of students who sit either 2nd or 3rd rows of the classroom was higher than that from 1st or 4th row.

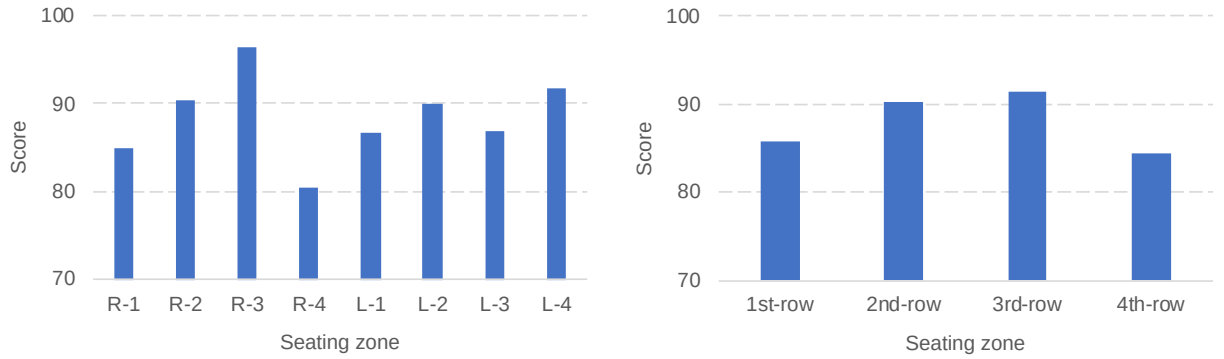


Figure 3. Average scores of quiz #2 about the third learning objective, "Correlate hydraulic properties of soils in relevance with their classification." (left: with different seating zones from R-1 to L-4; right: with different rows in the classroom).

4.3 Midterm Student Survey

The midterm student survey was conducted after midterm exam #1, which covers the first and second learning objectives. Four main questions in the survey are shown below (Q1-Q4). The full survey form is in the appendix.

Q1. Homework: is it helpful for achieving these key objectives?

Not at all (1)	Sometimes (2)	Intermediate (3)	Mostly helpful (4)	Very helpful (5)

Q2. Problem solving: is instructor's example solving during the lecture time helpful for you to digest the contents of lecture materials?

Not at all (1)	Sometimes (2)	Intermediate (3)	Mostly helpful (4)	Very helpful (5)

Q3. Exam: how do you think was the level of difficulty for the first mid-term exam?

Very difficult (1)	Somewhat difficult (2)	Intermediate (3)	Somewhat easy (4)	Very easy (5)

Q4. Which grade do you expect to receive at the end of the semester?

Lower than C- (1)	C to C+ (2)	B- to B (3)	B+ to A- (4)	A to A+ (5)

Figure 4 shows the response from students for these questions, Q1-Q4. Below is the analysis of these responses:

- Q1: homework assignments seem quite helpful for students to achieve key learning objectives. The average response is "mostly helpful (4)".
- Q2: actual problem solving during the lecture time is regarded as good for achieving the key learning objectives. Again, the average response is "mostly helpful (4)".
- Q3: the first midterm exam was deemed between somewhat difficult (2) and intermediate (3) level to students.
- Q4: students' expected grades vary, but the average is between B- to A- (3 & 4). It may imply that students feel that they are following well with the course.

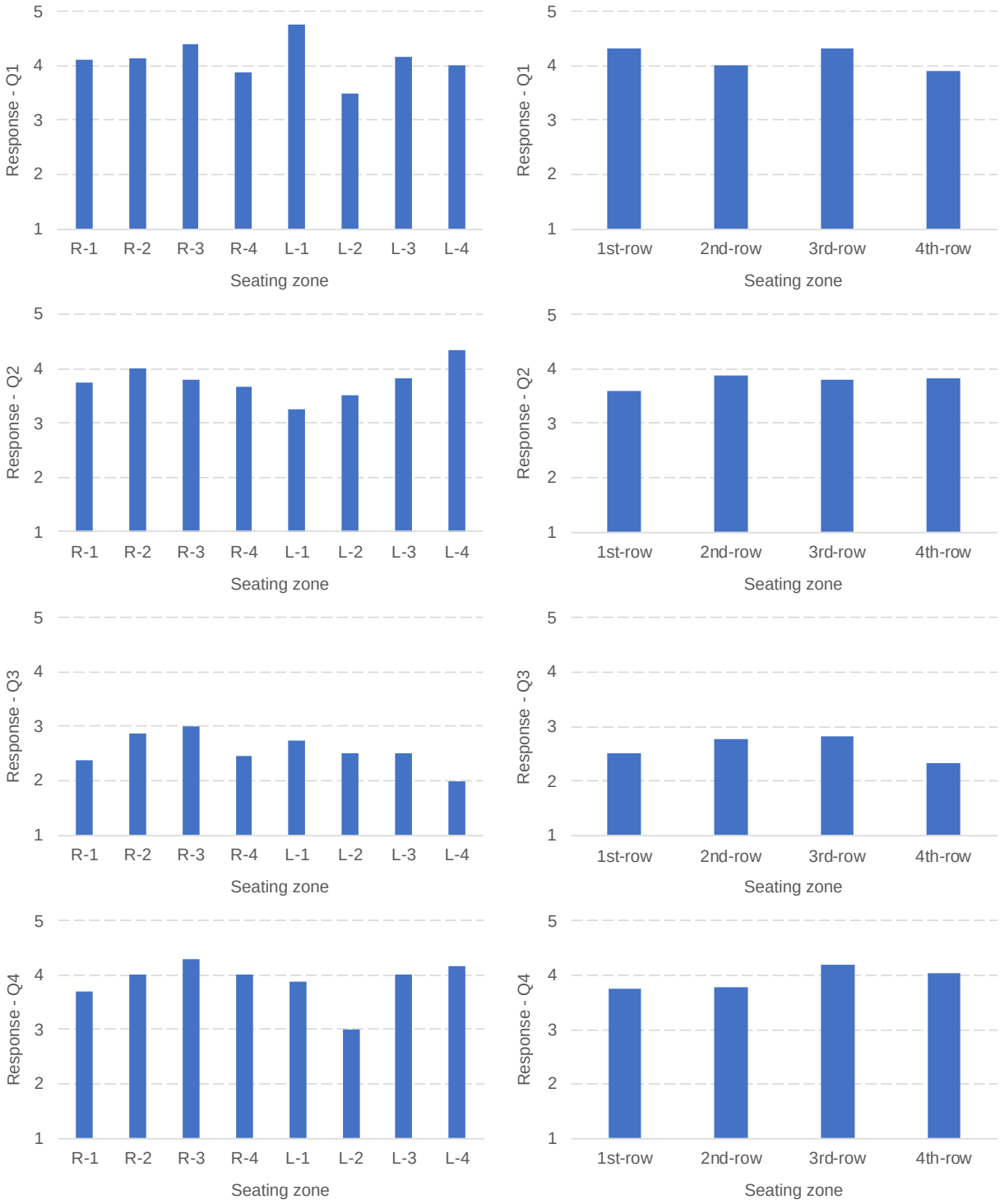


Figure 4. Average responses of four main questions (Q1-Q4) in the midterm student survey. (left: with different seating zones from R-1 to L-4; right: with different rows in the classroom).

4.4 Quiz #3

Quiz #3 was conducted to evaluate the achievement of fourth objective "Identify mechanical behavior of soils (deformation, stiffness, and strength) with their classification and presence of water." The instructor again showed multiple examples of solving problems before the quiz to ensure the students' learning. Quiz #3 is shown in the appendix. Figure 5 shows the score of quiz #3. A difference between the right and left side of the classroom was not apparent in this case as well. But the scoring average was around 80-85, which was less than the target level of 90. It may be partly because many students missed the class during this time due to bad weather, school event, etc. The instructor noted that the average score of students who sit either 2nd or 3rd rows of the classroom was higher again than that from 1st or 4th row.

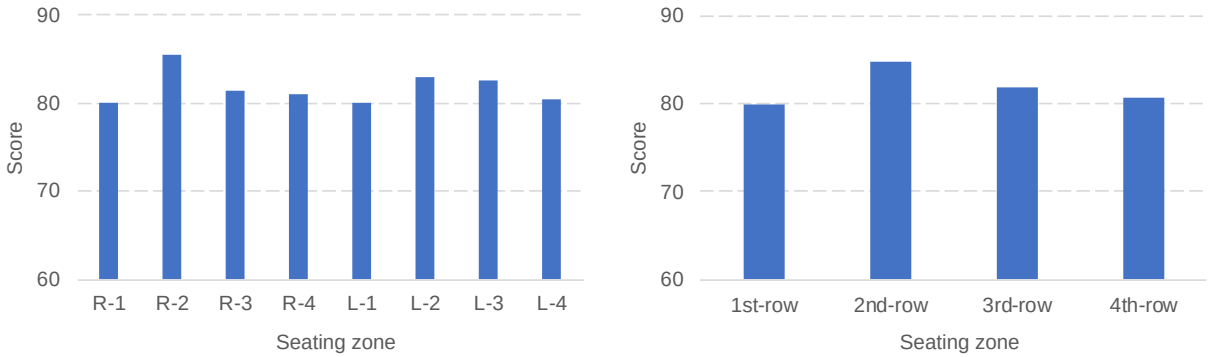


Figure 5. Average scores of quiz #3 about the fourth learning objective, "Identify mechanical behavior of soils (deformation, stiffness, and strength) with their classification and presence of water." (left: with different seating zones from R-1 to L-4; right: with different rows in the classroom).

4.5 Final Student Survey

The final student survey was conducted on the final exam date, which covers all the key learning objectives. Questions about the five main objectives (O1-O5) in the survey are shown below. The full survey form is in the appendix.

Objective 1: "Understand soils as an important construction material." How would you evaluate yourself on achieving this objective?

Not at all (1)	To some extent (2)	Satisfactory (3)	Good (4)	Very good (5)

Objective 2: "Understand how soils can be categorized into different groups based on their index and physical properties." How would you evaluate yourself on achieving this objective?

Not at all (1)	To some extent (2)	Satisfactory (3)	Good (4)	Very good (5)

Objective 3: "Understand the hydraulic properties of soils in relevance with their classification." How would you evaluate yourself on achieving this objective?

Not at all (1)	To some extent (2)	Satisfactory (3)	Good (4)	Very good (5)

Objective 4: "Understand the mechanical behavior of soils (deformation, stiffness, and strength) with their classification and the presence of water." How would you evaluate yourself on achieving this objective?

Not at all (1)	To some extent (2)	Satisfactory (3)	Good (4)	Very good (5)

Objective 5: "Apply mathematical formulae to predict such a hydraulic-and-mechanical response of soils." How would you evaluate yourself on achieving this objective?

Not at all (1)	To some extent (2)	Satisfactory (3)	Good (4)	Very good (5)

Figure 6 shows the response from students for their achievements with the key objectives, O1-O5. Below is the analysis of these responses:

- Objectives 1&2: students' average level of achievements is about good (4). Their performance in the midterm exam #1 was also satisfactory.
- Objective 3: students' average level of achievements is between good (4) and satisfactory (3). Their performance in the midterm exam #2 was also good.
- Objectives 4&5: students' average level of achievement is about satisfactory (3). On the other hand, their performance in the final exam was not good. Obviously, objectives 4 and 5 are not an easy goal for students.

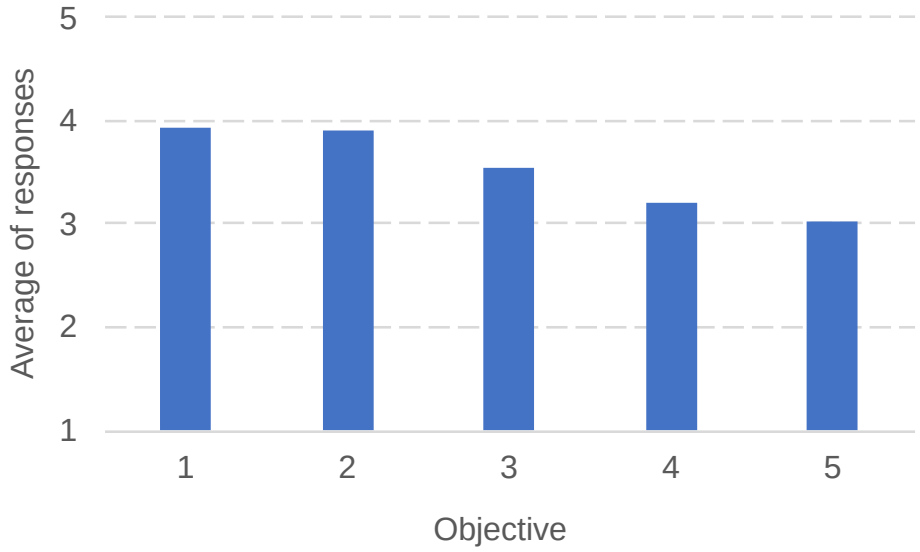


Figure 6. Average responses about the students' achievement level of five key learning objectives (O1-O5) from the final student survey.

5. Summary and Reflections

This course presents an additional challenge coming from diverse bodies of students. For example, most students answered that they work at least part-time while doing the course work. Figure 7 (left) shows the response of students on the following inquiry:

Do you currently have a job? Please select what is your status below:

(1) Full-time job in Civil Engineering or related field
(2) A part-time job in Civil Engineering or related field
(3) Internship in Civil Engineering or related field
(4) Full-time, part-time, or internship in other fields
(5) None of the above
(6) I don't want to answer

More than 30 students responded that they are doing an internship in Civil Engineering or related field (3), while about 16 students responded that they are working either a full-time or part-time job in Civil Engineering or related field (1&2). In addition, about 11 students responded that they are doing either full-time, part-time, or internship in other fields (4). These combined number of (1)-(4) is more than 75% of all students. It implies that many students may not have enough time to study after the class, compared to other full-time students. Moreover, more than 10 students are from different major other than Civil Engineering (Figure 7, right). Given those circumstances, showing many problems/examples solving could help students achieve the key learning objectives set for this course.

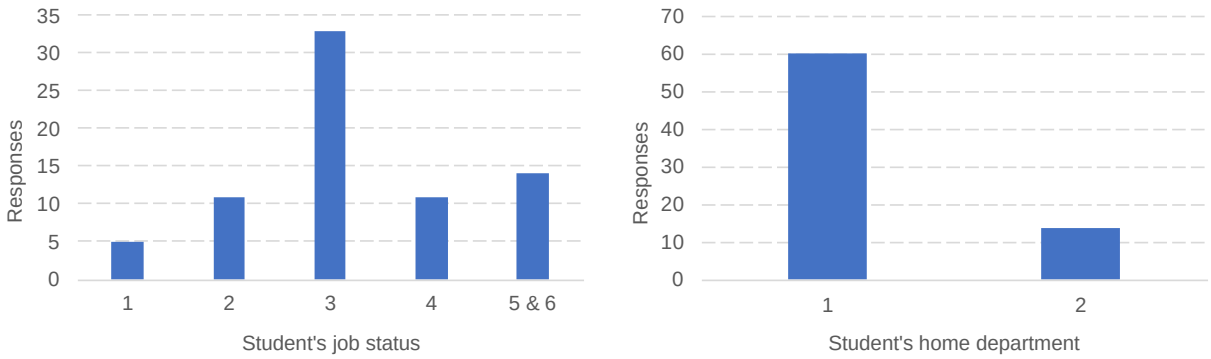


Figure 7. Responses from students about their job status while taking this course (left) and their major (right; 1: Civil Engineering, 2; Other majors).

Lastly, all scores from quizzes, attendance, homework assignments, two midterm exams, one final exam, and lab reports are incorporated to make the final combined scores. Figure 8 shows the breakdown of the final combined scores concerning the different sitting area of students. Noticeably, the average score of students on the right side of the classroom is much higher than that on the left side of the classroom (80/100 vs. 72/100). There are two reasons for the better performance of students on the right side of the classroom:

(1) The instructor had more interactions with students on the right side of the classroom due to the asymmetric nature of the classroom, and
(2) The attendance rate of students is higher on the right side of the classroom throughout the semester.

In particular, the attendance rate of students on the left side of the classroom was conspicuously low during the last four weeks of the course for some reason.

Based on those observations, the instructor plans to apply several strategies to improve students' achievement of key learning objectives in the next year:

- Given that the higher percentage of working students, allocate more time for the problem/example solving during the class time.
- To facilitate more interactions with students, ask questions to students more frequently during the class time.
- Implement a shorter format of quizzes with higher frequencies to check students' learning with respect to the key objectives.
- Given lower attendance rate of students compared to the full-time students, attempt to record the whole lecture and post it in the course website (for a limited period) so that students can catch up before the next class.

Interestingly, the performance of students in the second and third rows of the classroom has been better than that of students in the first and last lows of the classroom throughout the course. There is no good explanation about this observation, and so the instructor will continue to examine the performance of students in the different sitting area next year.

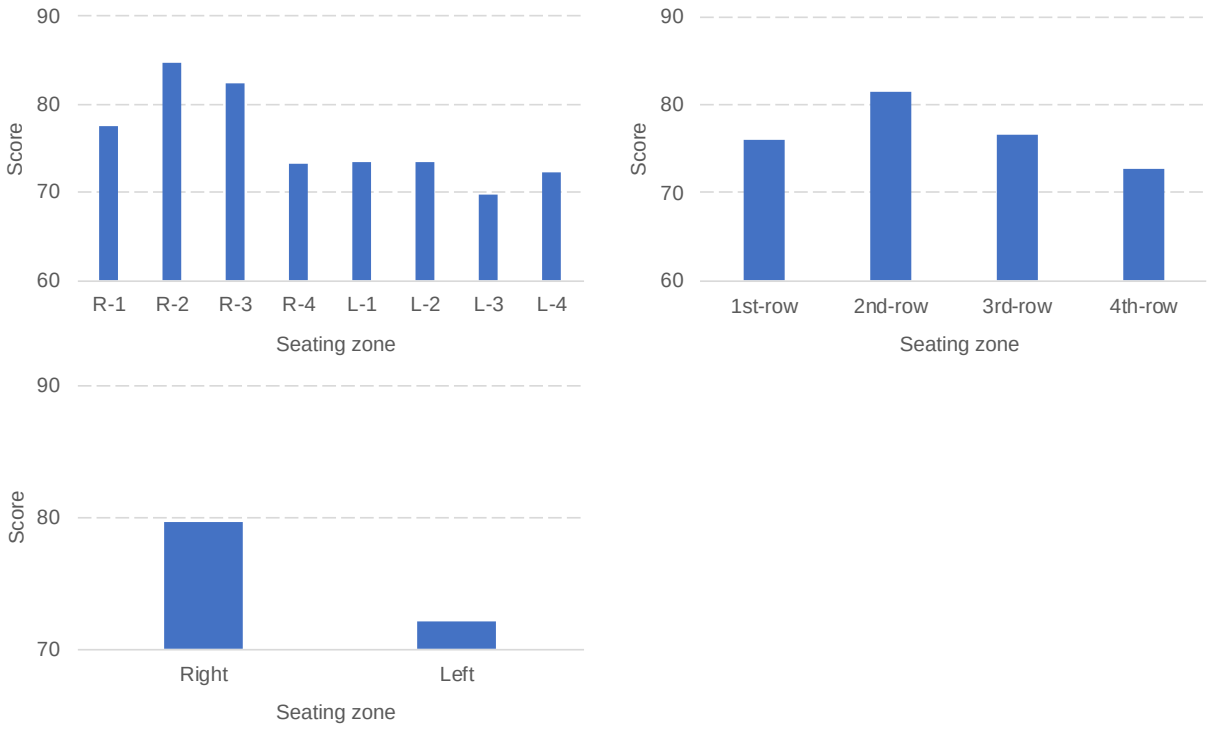


Figure 8. Averages of final combined score of students; with respect to the different seating zone (above-left), the different seating row (above-right), and the different side (below-left). The final combined score is made by incorporating scores from quizzes, attendance, homework, two midterm exams, one final exam, and lab report with different weights.

Appendix: Quizzes, Student Surveys, and Syllabus

Quiz #1

CIVE 334 Introduction to Geotechnical Engineering

Name: _____

Your seat (circle one): R-1, R-2, R-3, R-4, L-1, L-2, L-3, L-4

Quiz #1

(note: this quiz will be reflected in your grading, and will be used for checking your attendance)

So far, we covered Ch. 2 (Origin of Soil and Grain Size), Ch. 3 (Weight-Volume Relationships), and Ch. 4 (Plasticity and Structure of Soil).

Soils can be categorized either coarse-grained or fine-grained soils.

1. For the coarse-grained soils, what do you think is the parameter among the list below that will affect the engineering behavior of them the most? And why?

(1) Origin of soil

(2) Grain size distribution

(3) Particle shape

(4) Relative density

2. For the fine-grained soils, what do you think is the parameter among the list below that will affect the engineering behavior of them the most? And why?

(1) Mineralogy

(2) Atterberg Limits

(3) Liquidity index

(4) Activity

Quiz #2

CIVE 334 Introduction to Geotechnical Engineering

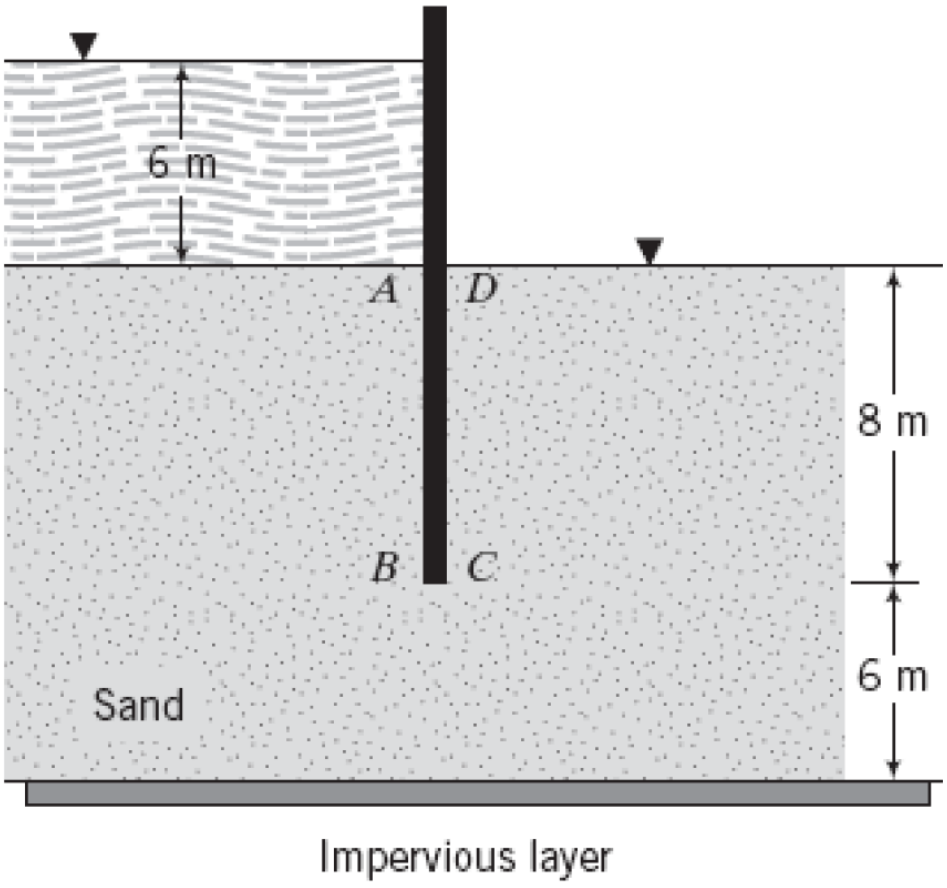
Name: _____

Your seat (circle one): R-1, R-2, R-3, R-4, L-1, L-2, L-3, L-4

Quiz #2

(note: this quiz will be reflected in your grading, and will be used for checking your attendance)

A sheet pile wall supporting 6 m of water is shown in Figure below. Draw the flow net.



What is the ratio of the number of flow channels (N_f) to the number of potential drops (N_d)?

Midterm Student Survey

CIVE 334 Introduction to Geotechnical Engineering

Mid-term course survey

Your seat (circle one): R-1, R-2, R-3, R-4, L-1, L-2, L-3, L-4

1. Status: are you a full-time or part-time student?
   1) Full-time
   2) Part-time

The key objectives of this class are as follows:
1) Understand soils as an important construction material.
2) Understand how soils can be categorized into different groups based on their index and physical properties.
3) Understand the hydraulic properties of soils in relevance with their classification.
4) Understand the mechanical behavior of soils (deformation, stiffness, and strength) with their classification and the presence of water.
5) Apply mathematical formulae to predict such a hydraulic-and-mechanical response of soils.

2. Homework: is it helpful for achieving these key objectives?

Not at all	Sometimes	Intermediate	Mostly helpful	Very helpful

3. Problem solving: is instructor's example solving during the lecture time helpful for you to digest the contents of lecture materials?

Not at all	Sometimes	Intermediate	Mostly helpful	Very helpful

4. Exam: how do you think was the level of difficulty for the first mid-term exam?

Very difficult	Somewhat difficult	Intermediate	Somewhat easy	Very easy

5. Which grade do you expect to receive at the end of the semester?

Lower than C-	C to C+	B- to B	B+ to A-	A to A+

6. On an average basis, how many hours per week do you spend for this class?

0-2 hours	2-4 hours	4-6 hours	6-8 hours	> 8 hours

7. Please, supply any comment/opinion that you think can help to better achieve the key objectives of this course.

Quiz #3

CIVE 334 Introduction to Geotechnical Engineering

Name: _____

Your seat (circle one): R-1, R-2, R-3, R-4, L-1, L-2, L-3, L-4

Survey

Do you currently have a job? Please select what is your status below:

(1) Full-time job in Civil Engineering or related field
(2) Part-time job in Civil Engineering or related field
(3) Internship in Civil Engineering or related field
(4) Full-time, part-time, or internship in other fields
(5) None of above
(6) I don't want to answer

What is your major? (1) Civil Engineering, (2) Architectural Engineering & Construction, (3) Etc.

Consent

Could you agree that your data is used for the course analysis/evaluation?

(1) Yes
(2) No

Quiz #3

(note: this quiz <u>will NOT be</u> reflected in your grading, but will be used for checking your attendance)

1. Consolidation: If you want to identify how long it would take before the consolidation is completed, which information do you need? (you can select multiple answers)

(1) compression and recompression index, C_c *and* C_s
(2) coefficient of consolidation, C_v
(3) average longest drainage path, H_{dr}
(4) initial void ratio, e_0

2. Triaxial test: If you want to obtain the effective friction angle of soil, ϕ', which condition would you apply? (you can select multiple answers if you want).

(1) Consolidated-drained (CD) test
(2) Consolidated-undrained (CU) test
(3) Unconsolidated-undrained (UU) test
(4) Unconfined compression test

3. Triaxial test: If you want to obtain the undrained shear strength of soil, c_u, which condition would you apply? (you can select multiple answers if you want).

(1) Consolidated-drained (CD) test
(2) Consolidated-undrained (CU) test
(3) Unconsolidated-undrained (UU) test
(4) Unconfined compression test

Final Student Evaluation

CIVE 334 Introduction to Geotechnical Engineering

Final-exam course survey

The key objectives of this class are as follows:

1) Understand soils as an important construction material.
2) Understand how soils can be categorized into different groups based on their index and physical properties.
3) Understand the hydraulic properties of soils in relevance with their classification.
4) Understand the mechanical behavior of soils (deformation, stiffness, and strength) with their classification and the presence of water.
5) Apply mathematical formulae to predict such a hydraulic-and-mechanical response of soils.

Objective 1: "Understand soils as an important construction material." How would you evaluate yourself on achieving this objective?

Not at all	To some extent	Satisfactory	Good	Very good

Objective 2: "Understand how soils can be categorized into different groups based on their index and physical properties." How would you evaluate yourself on achieving this objective?

Not at all	To some extent	Satisfactory	Good	Very good

Objective 3: "Understand the hydraulic properties of soils in relevance with their classification." How would you evaluate yourself on achieving this objective?

Not at all	To some extent	Satisfactory	Good	Very good

Objective 4: "Understand the mechanical behavior of soils (deformation, stiffness, and strength) with their classification and the presence of water." How would you evaluate yourself on achieving this objective?

Not at all	To some extent	Satisfactory	Good	Very good

Objective 5: "Apply mathematical formulae to predict such a hydraulic-and-mechanical response of soils." How would you evaluate yourself on achieving this objective?

Not at all	To some extent	Satisfactory	Good	Very good

Syllabus: CIVE 334-001 INTRODUCTION TO GEOTECHNICAL ENGINEERING
SPRING SEMESTER, 2019

Instructor: Dr. Seunghee Kim (Office: PKI 204D)
Communication: seunghee.kim@unl.edu/ phone: 402-554-3547/ Canvas (http://canvas.unomaha.edu)
Class meeting: Tuesday and Thursday, 1:30pm - 2:45pm (Class location: 102 A/B STC)
Office hours: Tuesday and Wednesday, 3:00pm - 4:30pm/ or by appointment
TA: Amin Hosseini Zadeh (amin@unl.edu),
Jingtao Zhang (jingtao.zhang@huskers.unl.edu), and
Mostafa Afzalian (mafzalian@unomaha.edu)
TA's office hours: PKI 136
Pre-requisite: MECH 373 Mechanics of Elastic Bodies
Parallel: CIVE 310 Fluid Mechanics
Textbook: Principles of Geotechnical Engineering, by Braja M. Das and Khaled Sobhan; Cengage Learning (9th edition) ISBN: 978-1-305-97093-9 (hard copy)
Soil Mechanics Laboratory Manual, by Braja M. Das; Oxford University Press (9th edition) ISBN: 978-0-19-020966-7 (hard copy)
References: Soil Mechanics, by T.W. Lambe and R. Whitman, Wiley and Sons
Soil Mechanics and Foundations, by M. Budhu, Wiley

Course Description: Soils are fundamental constituents of the earth, and structures are built on soils. This class deals with testing and identification of soils, flow through earth structures, stress distribution, consolidation and settlement, shear strength, earth pressure, slope stability, and shallow foundation problems. These topics are essential components for the design of earth structures. The knowledge acquired in this class can be used for the basic design and analysis of the earth structures. During this course, students will be trained to see the earth structures with the engineering point of view that is based on the critical way of thinking. This course is critical for students to have foundational knowledge about soil mechanics and geotechnical engineering, and essential to understanding other advanced topics in the sub-discipline of geotechnical engineering.

Goal: After successfully passing this course, students should be capable of the following aspects.

- Understand soils as an important construction material.
- Understand how soils can be categorized into different groups based on their index and physical properties.
- Understand the hydraulic properties of soils in relevance with their classification.
- Understand the mechanical behavior of soils (deformation, stiffness, and strength) with their classification and presence of water.
- Apply mathematical formulae to predict such a hydraulic-and-mechanical response of soils.

How the academic/learning goals will be assessed: through the results of midterm and final exams, several homework assignments, and quizzes.

Course Requirements:

Lecture-specific Readings and Homework Assignments

Reading selections and homework problems are assigned to accompany each lecture and will be announced at the end of the lecture. Therefore, it is your responsibility to attend lectures or check with classmates. Students should complete each lecture's homework problems as a means of reviewing and clarifying the lecture content, using the book as a primary reference for further inquiry.

You may work together in small groups (not more than three people) to discuss and compare approaches to the problem set. But assignments must be submitted separately by each student.

Homework will be evaluated based on perceived effort and adherence to the required homework format. Students must submit their solutions at the beginning of class on the assigned due date. 10% of points will be deducted per day (including weekends), and zero credit will be given for homework submitted later than one week. You must slide the HW under the door to PKI 204D on the weekends. Indicate the day that you submitted late HW on the cover page (if not, I will record the date I received it).

The required homework format is designed to reinforce effective engineering problem-solving strategies and to further develop effective technical communication skills. To receive homework credit, solutions must be organized and presented as follows:

- Use the front side only.
- Redraw a diagram using a ruler w/ all dimensions & units clearly labeled.
- Annotate all steps of your solution procedure linearly.
- Box of underline final answers and show units.

Attendance

Attendance of all lectures is critical for success in the course. Unannounced quizzes may be given throughout the semester to motivate attendance. If you persist in missing class, it is your responsibility to stay up-to-date with course announcements, assignments, and material on your own (by asking your colleagues, studying the book, etc.). I will not re-teach material during office hours to students who do not attend class.

Methodology: Class lectures and discussion, homework, quizzes, reports, and exams

Grading:

Attendance & Quizzes	5%
Homework	10%
Two midterm exams	40%
Lab session	25%
Final exam(May 2nd, 12:30-2:30pm)	20%

Failure to attend an exam will lead to a mark of zero. The only exception will be for documented medical emergencies. For the midterm exam, you must notify me, in writing, of any scheduling conflicts with the exam a MINIMUM of three days before scheduled exam date. There will be no make-up exams for students who do not show up. All exams are a closed book. Students must use a mechanical calculator that is allowed for the FE exam (*e.g.*, CASIO fx-115MS).

Final exam: The Institute-mandated schedule will be followed for all students except those who provide official documentation of two additional final exams the same day as the official final exam period for this course. This request must be submitted in writing a MINIMUM of two weeks before the final exam date. The only period for qualifying students will be the Institute-determined conflict period.

Academic Integrity:

Academic honesty is essential to the existence and integrity of an academic institution. The responsibility for maintaining that integrity is shared by all members of the academic community. To further serve this end, the University supports a Student Code of Conduct which addresses the issue of academic dishonesty. In accordance with the established procedures as described in the Code, students who commit acts of academic dishonesty are subject to disciplinary action and are granted due process and the right to appeal any decision.
Any questions regarding the procedures for handling incidents of academic dishonesty may be directed to the Office of Academic and Student Affairs. (http://www.unomaha.edu/student-life/student-conduct-and-community-standards/policies/academic-integrity.php)

Office Hours:

Students are strongly encouraged to regularly come by during office hours for help with homework problems or to discuss specific questions you have from the course. Attempt homework problems before asking me questions and bring your attempted solution with you. This allows us to efficiently review your solution process and identify the issue. Respect both of our time by coming prepared.
I will do my very best to provide undistracted instruction during scheduled office hours. In turn, I will generally NOT be available outside of scheduled office hours, even when I am in my office. Special office hours may be scheduled by email.

Email: When you send email messages, please write exactly **CIVE 334 (SPRING 2019)** in the subject header. If you require special accommodations, you must notify me ASAP in writing.

Other Information:
1. Changes in syllabus and assignment sheet may be modified as deemed appropriate. All changes will be announced in class.
2. Students with a disability are encouraged to visit the Accessibility Services Center (ASC). The Accessibility Services Center (ASC) collaborates with students, administrators, faculty, and staff to ensure providing reasonable and appropriate accommodations for students with disabilities. The office provides a full range of campus support services to ensure the success of the students. (http://www.unomaha.edu/student-life/inclusion/disability-services/index.php)
3. Any student who is unable, because of his religious beliefs, to attend classes or to participate in any examination, study, or work requirement on a particular day shall be excused from any such examination or study or work requirement, and shall be provided with an opportunity to make up such examination, study, or work requirement which he may have missed because of such absence on any particular day; provided, however, that such makeup examination or work shall not create an unreasonable burden upon such school.
4. There is NO extra assignment for the make-up.

All cell phones must be switched off during class time. Unauthorized web surfing or instant messaging during class time is not permitted.

Course Schedule: CIVE 334 Introduction to Geotechnical Engineering

Week	Topic	Reading	No class
1 (1/7-1/11)	Introduction Origin of soil and grain size	Ch. 1 Ch. 2	
2 (1/14-1/18)	Weight-volume relationships of soil	Ch. 3	
3 (1/21-1/25)	Plasticity and structure of soil	Ch. 4	
4 (1/28-2/1)	Classification of soil	Ch. 5	
5 (2/4-2/8)	Soil compaction -End of the physical properties of soils	Ch. 6	
6 (2/11-2/15)	Permeability Seepage	Ch. 7 Ch. 8	
7 (2/18-2/22)	***MIDTERM EXAM 1*** Seepage -End of the hydraulic properties of soils	 Ch. 8	
8 (2/25-3/1)	In-situ stresses	Ch. 9	
9 (3/4-3/8)	Stresses in a soil mass	Ch. 10	
10 (3/11-3/15)	Compressibility of soil	Ch. 11	
11 (3/18-3/22)	**Semester Break**		3/19-21
12 (3/25-3/29)	**Geo-Congress 2019** Compressibility of soil	 Ch. 11	3/26
13 (4/1-4/5)	Shear strength of soil ***MIDTERM EXAM 2***	Ch. 12	
14 (4/8-4/12)	Shear strength of soil	Ch. 12	
15 (4/15-4/19)	Lateral Earth pressure	Ch. 13	
16 (4/22-4/26)	Slope stability - End of the mechanical properties of soils	Ch. 15	
17 (4/29-5/3)	***FINAL EXAM (Thursday, May 2nd, 12:30pm-2:30pm)***		

NOTE: This is not a firm list. There may be an addition or a deletion during the semester.

Syllabus: **CIVE 334-002, 003, 004 INTRODUCTION TO GEOTECHNICAL ENGINEERING LAB**
SPRING SEMESTER, 2019

Instructor: Dr. Seunghee Kim (Office: PKI 204D)
Communication: seunghee.kim@unl.edu/ phone: 402-554-3547/
Canvas (http://canvas.unomaha.edu)
Class meeting: 002: Tuesday 4:30pm - 7:00pm
003: Thursday 4:30pm - 7:00pm
004: Wednesday 4:30pm - 7:00pm (Class location: PKI 127)
Office hours: Tuesday and Wednesday, 3:00pm - 4:30pm/ or by appointment
TA: Amin Hosseini Zadeh (amin@unl.edu),
Jingtao Zhang (jingtao.zhang@huskers.unl.edu), and
Mostafa Afzalian (mafzalian@unomaha.edu)
TA's office hours: PKI 136 (it is desirable to contact them via e-mail in advance)
Textbook: Principles of Geotechnical Engineering, by Braja M. Das and Khaled Sobhan; Cengage Learning (9th edition) ISBN: 978-1-305-97093-9 (hard copy)
Soil Mechanics Laboratory Manual, by Braja M. Das; Oxford University Press (9th edition) ISBN: 978-0-19-020966-7 (hard copy)
References: Soil Mechanics, by T.W. Lambe and R. Whitman, Wiley and Sons
Soil Mechanics and Foundations, by M. Budhu, Wiley

Course Description: Soils are fundamental constituents of the earth, and structures are built on the soils. This lab class deals with the investigation of physical, hydraulic, and mechanical properties of soils through laboratory tests.

Goal: After successfully passing this course, students should be capable of the following aspects.

- Understand soils as an important construction material.
- Understand how soils can be categorized into different groups based on their index and physical properties.
- Understand the hydraulic properties of soils in relevance with their classification.
- Understand the mechanical behavior of soils (deformation, stiffness, and strength) with their classification and presence of water.
- Apply mathematical formulae to predict such a hydraulic-and-mechanical response of soils.

Attendance:
Attendance is critical for the success of this lab class, so students are required to attend all lab activities. There will be a one-or-two drop in the final grade for any absences without an acceptable excuse.

Lab Report:

Each group is required to submit a lab report for every session. The lab report must be turned in at the beginning of the lab section on the due date. The report will be due one week after the *completion* of the lab. The report should include the name of the students, the title of the experiment, date and group number, introduction of the work, plots, results, discussion, and reference. The report should have a formal look (word processed). The grade will depend on the technical integrity as well as the engineering presentation of work turned in.

Other:

You are expected to clean up your work area and lab materials after your lab is finished. Groups that do not clean up will have one letter deducted from their lab report grade for that session.

There are several general rules that you need to follow:

(1) Do NOT wash soil down the sink. Place unused soils in the disposal buckets located around the lab.
(2) If instructed, make sure to use an eyewear.
(3) Do NOT adjust the temperature on the soil ovens.
(4) There may be running experiments in this lab. Please do NOT disturb these experiments.
(5) Use a glove when inserting/removing samples from the oven.

Course Schedule: CIVE 334 Introduction to Geotechnical Engineering Lab

Week	No.	Topic	Remarks
1 (1/7-1/11)	1	Introduction, Grouping, Lab Tour, Safety Precaution	
2 (1/14-1/18)	2	Water content, Specific gravity	ASTM D-2216
3 (1/21-1/25)	3	Grain size distribution – Sieve and hydrometer analysis	ASTM D-421/422/2487
4 (1/28-2/1)	4	Atterberg limit (limit & plastic limit) test	ASTM D-4318
5 (2/4-2/8)	5	Compaction test	ASTM D-698
6 (2/11-2/15)	6	Field unit weight of compaction (sand cone), minimum & maximum dry densities	ASTM D-1556
7 (2/18-2/22)		**Midterm Exam 1: No Lab**	
8 (2/25-3/1)	7	Permeability test (constant head)	ASTM D-2434
9 (3/4-3/8)	8	Permeability test (falling head) and flow net	ASTM D-5084
10 (3/11-3/15)	9	Consolidation test (1)	ASTM D-2435
11 (3/18-3/22)		**Semester Break**	
12 (3/25-3/29)	9	Consolidation test (2)	ASTM D-2435
13 (4/1-4/5)		**Midterm Exam 2: No Lab**	
14 (4/8-4/12)	10	Direct shear test	ASTM D-3080
15 (4/15-4/19)	11	Unconfined compression test	ASTM D-2166
16 (4/22-4/26)	12	Triaxial test	ASTM D-2850
17 (4/29-5/3)		**Final Exam Week: No Lab**	

NOTE: This is not a firm list. There may be an addition or a deletion during the semester.