

## SPRING 2015 (CRN 17870 & 17871)

### CE 351 – INTRODUCTORY SOIL MECHANICS Department of Civil and Environmental Engineering West Virginia University

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<b>Lecture Schedule</b>	: 9:30 am – 10:45 am, Tuesday and Thursday
<b>Meeting Location</b>	: Engineering Sciences Building, ESB-G84
<b>Lab Schedule</b>	: 2:00 pm – 4:50 pm, Tuesday and Thursday
<b>Meeting Location</b>	: Engineering Sciences Building, ESB-207
<b>Instructor</b>	: Dr. Raj K. Gondle Office: Engineering Sciences Building, ESB-641B Phone: (304) 293-9954 or (304) 293-3024 Email: Raj.Gondle@mail.wvu.edu
<b>Office Hours</b>	: 10:00 am – 11:00 am, Monday 11:00 am – 12:00 pm, Thursday Also, after class hours or by appointment
<b>Prerequisites</b>	: MAE 243 – Mechanics of Materials
<b>Credits</b>	: 4 Credit Hours

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**Textbook** : Das, B. M. and Sobhan K. (2014). *Principles of Geotechnical Engineering*. 8<sup>th</sup> Edition, Cengage Learning, Stamford, CT, USA.

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#### **Course Overview:**

The objective of this course is to introduce the subject of soil mechanics and provide the basics of geotechnical engineering to all civil engineering students. In this course, students will understand the basics of soils through hands on experience in the geotechnical laboratory. Some of the important topics that students will learn during the course: soil structure and grain size; identification and classification of soils for engineering purposes; physical and engineering properties of soils; fundamental behavior of soils subjected to various forces; groundwater and seepage through soils; compaction; consolidation; shear strength; and bearing capacity of soils. Students will get acquainted to several geotechnical problems and documentation of geotechnical observations. Upon successful completion of the course, students should be able to apply fundamentals of soil mechanics and principles of geotechnical engineering in the analysis, design, and construction of civil engineering projects.

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**ABET Expected Learning Outcomes:**

After completing this course, students will be able to:

Course Outcome Description	ABET Program Outcomes*
1. Learn how to determine engineering properties of soils in the lab and prepare lab reports	(b), (g)
2. Learn about soil classification, soil compaction, flow of water through soils, concept of effective stress, consolidation, and shear strength of soils	(b), (e)
3. Learn about stresses and stress increments in a soil mass.	(e)

\*ABET Program Outcomes:

(b) Design, conduct experiments/analyze and interpret data

(e) Identify, formulate, and solve civil engineering problems

(g) Communicate effectively in oral, written, and electronic formats

**Tentative Schedule:**

Attachment # 1 and Attachment # 2 contain tentative lecture schedule and laboratory schedule, respectively.

**Course Grading:**

Grading will be based upon exams, homework's, laboratory performance, and surprise quizzes. The relative percentage is given as following:

Exam 1	.....	25%
Exam 2	.....	25%
Exam 3	.....	25%
Lab Grade	.....	10%
Homework	.....	10%
Quiz(s)	.....	5%
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		100%

**Attendance:**

A sign-in sheet will be provided at the beginning of every lecture class and laboratory section. Students are expected to attend all lecture and laboratory classes on time. Those who fail to attend classes regularly are inviting scholastic difficulty. Attendance for laboratory sessions is mandatory. NO make-up labs.

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### **Reading Assignments:**

Reading assignments from the recommended textbook are required. Reading material for each lecture will be based on the topics covered in classroom, and is given in Attachment 1. Additional reference material will be provided as handouts in classroom or electronically when needed. If you are interested in learning more about a particular topic, please come see me during my office hours or I suggest that you consult the references listed in the textbook. The assigned reading material is important and recommended for a thorough understanding of the course material.

### **Homework:**

Homework assignments will be given after each topic or whenever a major portion of the subject is covered in the classroom. A due date will be specified with every assignment. Late homework will not be accepted unless a valid excuse is presented and a written request with explanations. Students are expected to submit their homework neatly and concisely by providing necessary sketches, graphs, and calculations. Student homework with incomplete work will not receive any credit. Although homework does not account directly for a large percentage of your grade, understanding and solving homework problems will assist you in solving exam problems. Therefore, I strongly urge you to do your own work and to see me if you are having difficulties with an assignment or topic.

### **Exams:**

All exams will be held in the classroom and will be closed book/notes. Only calculators will be permitted for use during exams. Use of electronics such as mobile phones, laptops, or e-book readers is not permitted. Exams will be based on the course material covered in the classroom and may include information given in the laboratory.

### **Laboratory:**

Each student must register for a laboratory section assigned to the course. The geotechnical laboratory is located in ESB B-20. Every student must prepare for the laboratory work prior to coming to each scheduled session. This preparation should include reading the appropriate section of the lab manual and noting significant steps in the experimental work. Please do not disturb tests which are already in progress.

### **Make-up Lectures:**

Faculty and staff members have obligations of diverse nature. Some of the duties of the geotechnical faculty and staff include serving on various technical committees, attending research conferences and presenting technical papers. Instructor will make every effort not to miss any class. However, if the circumstances are such that a class has to be missed by the instructor, a substitute lecture will be given by a qualified instructor or a make-up class will be arranged.

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**Social Justice Statement:**

West Virginia University is committed to social justice. I concur with that commitment and expect to foster a nurturing learning environment based upon open communication, mutual respect, and non-discrimination. Our University does not discriminate on the basis of race, sex, age, disability, veteran status, religion, sexual orientation, color or national origin. Any suggestions as to how to further such a positive and open environment in this class will be appreciated and given serious consideration.

If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class, please advise me and make appropriate arrangements with Disability Services (293-6700).

**Academic Conduct:**

West Virginia University Academic Integrity: The integrity of the classes offered by any academic institution solidifies the foundation of its mission and cannot be sacrificed to expediency, ignorance, or blatant fraud. Therefore, I will enforce rigorous standards of academic integrity in all aspects and assignments of this course.

Should you have any questions about possibly improper research citations or references, or any other activity that may be interpreted as an attempt at academic dishonesty, please see me before the assignment is due to discuss the matter.

**Final Comments:**

Food is disruptive and is not permitted during class or during laboratory sessions. No talking in the classroom or in the laboratory sections. Questions are encouraged during class or during lab sessions. Never hesitate to ask questions. Any comments on how to improve the course are particularly welcome.

Good luck with the course!

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**Attachment # 1: Tentative schedule and Reading assignments for CE 351**

<b>Lecture</b>	<b>Topic</b>	<b>Date</b>	<b>Reading</b>
1	Introduction to Geotechnical Engineering	January 13	Chapter 1
2	Soil Formation and Grain Size	January 15	Chapter 2
3	Weight-Volume Relationships	January 20	Chapter 3
4	Weight-Volume Relationships (Cont'd)	January 22	Chapter 3
5	Soil Plasticity and Atterberg limits	January 27	Chapter 4
6	Soil Classification	January 29	Chapter 5
7	Exploration and Sampling	February 3	Chapter 17
8	Compaction	February 5	Chapter 6
9	Compaction (Cont'd)	February 10	Chapter 6
10	<b>Exam 1</b>	February 12	-
11	Darcy's Law/Permeability	February 17	Chapter 7
12	Permeability (Cont'd)	February 19	Chapter 7
13	Seepage	February 24	Chapter 8
14	Flow Nets	February 26	Chapter 8

<b>Lecture</b>	<b>Topic</b>	<b>Date</b>	<b>Reading</b>
15	Total and Effective stress	March 3	Chapter 9
16	Stress Distribution	March 5	Chapter 10
17	Stress Distribution (Cont'd)	March 10	Chapter 10
18	Introduction to Consolidation	March 12	Chapter 11
19	Settlement Calculations	March 17	Chapter 11
20	<b>Exam # 2</b>	March 19	-
-	Spring Recess	March 24	-
-		March 26	
21	Preconsolidation pressures and field settlement curves	March 31	Chapter 11
22	Time Rate of Consolidation	April 2	Chapter 11
23	Introduction to Shear Strength; Mohr's Circle	April 7	Chapter 12
24	Measurement of Shear Strength; Mohr-Coulomb Failure Envelope	April 9	Chapter 12
25	Shear Strength of Sand and Clay	April 14	Chapter 12
26	Bearing Capacity and Shape Factors	April 16	Chapter 16
27	Bearing Capacity on Sand and Clay	April 21	Chapter 16
28	<b>Exam # 3</b>	April 23	-

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## LABORATORY INSTRUCTIONS

**Lab Schedule** : 2:00 pm – 4:50 pm, Tuesday and Thursday  
**Meeting Location** : Engineering Sciences Building, ESB-207, followed by a lab practice in the geotechnical laboratory located in ESB-B20

**Lab Instructor** : Dr. Raj K. Gondle  
Office: Engineering Sciences Building, ESB-641B  
Phone: (304) 293-9954 or (304) 293-3024  
Email: Raj.Gondle@mail.wvu.edu

### **Laboratory:**

Each student must register for a laboratory section assigned to the course. Every student must prepare for the laboratory work prior to coming to each scheduled session. This preparation should include reading the appropriate section of the lab manual and noting significant steps in the experimental work. Please do not disturb tests which are already in progress. Laboratory work will be divided into groups. Students are responsible of distributing the group's work. If one or more students do not participate, please notify your instructor immediately. At the end of each laboratory session each group is responsible for cleaning their work area, the tools and the instruments used. **DONOT THROW SOIL IN SINK!!**

**Attendance:** A sign-in sheet will be circulated at the beginning of each laboratory class, and the last person signing the sheet should promptly return it to the instructor. Students are required to come on time. Any student arriving late will not be given credit for the day's lab. The lab instructor reserves the right to withhold credit for a lab in the event of inattentiveness, disruptive behavior, or leaving class early. Signing for another student is considered cheating and will be reported to Academic Affairs.

**Lab Reports:** The laboratory schedule can be seen in Attachment # 2. The lab exercises and reports will be group exercises. Students will be placed into groups at the beginning of the semester. Lab reports will be due in one week and the reports should be submitted at the beginning of the next lab date. Late reports will not be accepted and will receive no credit. Please see Attachment # 3 for more details on report writing.

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**ATTACHMENT # 2: TENTATIVE SCHEDULE FOR THE LABORATORY**

<b>Laboratory</b>	<b>Date</b>	<b>Points</b>
Introduction	January 13, 2015	-
Lab #1: Specific Gravity and Water Content	January 20, 2015	10
Lecture	January 27, 2015	-
Lab #2: Grain Size Distribution	February 3, 2015	20
Lecture	February 10, 2015	-
Lab #3: Atterberg Limits	February 17, 2015	10
Lecture	February 24, 2015	-
Lab #4: Compaction (Standard Proctor/Modified)	March 3, 2015	20
Lecture	March 10, 2015	-
Lab # 5: Permeability/Hydraulic Conductivity	March 17, 2015	10
Lab # 6: Consolidation	March 31, 2015	10
Lab # 7: Direct shear	April 7, 2015	10
Lecture	April 14, 2015	-
Lab # 8: Tri-axial Compression	April 21, 2015	10
Lecture	April 28, 2015	-
<b>TOTAL POINTS</b>		<b>100</b>

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### ATTACHMENT # 3: REPORT FORMAT FOR LABS

Laboratory reports for each session should consist of:

**Cover Page** : Containing date, name of the test performed, group number, and list of group members. All the group members are required to document their effort.

**Introduction** : One page introduction.

**Procedure** : Detailed (step by step) explanation of the procedure.

**Calculations** : Showing all the calculations (with equations) made for the experiment. If the same calculation is performed repeatedly, then show only the first set of calculations and state that the following ones were obtained using the same formula.

**Results** : Tables or plots containing experiment results, and brief discussion on the results.

**Summary** : Providing a summary of the test conducted in the laboratory.

**Conclusions** : Using the experience from the laboratory experiment, literature and the results obtained, generate conclusions.

**Appendix** : This section should contain the data obtained in the lab and every other secondary graph or table used in this experiment.

**NOTE:** Failure to meet the above format in a lab report will result in a **deduction of 25%** of the grade for that report for all members in the group.