Summer 2019

# CE 341-141: Soil Mechanics

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CIVIL AND ENVIRONMENTAL ENGINEERING

NJIT New Jersey Institute of Technology

# CE 341- Soil Mechanics - Summer 2019
## Section: 141

**Text**: Das, B.M., and Sobhan, Khaled, Principles of Geotechnical Engineering, 9th Edition, Cengage Learning ISBN# 13: 978-1-305-97093-9

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*Prerequisites: Mech 237 Strength of Materials, Co requisite - CE 341A Soil Mechanics Laboratory*

| Day | Topics | Sections* |
|---|---|---|
| 1 | Introduction, Geology,<br>Origin of Soils, Clay Minerals | 2.1-2.6 |
| 2 | Particle Size Distribution and Atterberg Limits | 2.7-9, 4.1-8 |
| 3 | Soil Classification | Chapter 5 |
| 4 | Weight-Volume Relationships | 3.1-6 |
| 5 | Compaction | 6.1-9,11 |
| 6 | Hydraulic Conductivity, **Midterm Exam 1** | 7.1-6,9,10 |
| 7 | Seepage Drainage | 8.1-5,8 |
| 8 | Effective Stress | 9.1-5,9,10 |
| 9 | Mohr Circle, Geonvironmental Applications; Stress Distribution | 10.1-3, handout |
| 10, 11 | Consolidation, **Midterm Exams 2** | 11.4-14 |
| 12, 13 | Shear Strength | 12.1-12. 14 |
| 14 | Open topic | Handout |
| 15 | **Final Exam** | |

**Course Contents:** *A study of soil types and properties is made with the objective of developing a basic understanding of engineering behavior of soils. Engineering principles pertaining to compaction, permeability, seepage, consolidation, and shear strength are presented. The methods of subsurface investigation are introduced.*

* Refer to sections in textbook

**CE 341- Soil Mechanics Spring 2019**

**Course Objectives:**

1. Learn index properties of soils, methods of soil classification and subsurface investigations.
2. Learn principle of seepage through porous media and effective stress.
3. Learn principles of consolidation and shear strength.

**POLICIES**

• The NJIT Honor Code will be upheld and any violations will be brought to the immediate attention of Dean of Students.
• Students will be notified by the instructor to any modifications or deviations from the syllabus throughout the semester.

• **Absence from 4 or more weeks will result in a failing grade for the course.**
• Make sure that your email address stated in Moodle is correct and you are using it regularly. Communication from the instructor will be sent only to the NJIT e-mail address.
• Always bring your text book, a calculator and writing paper to class.
• All material handed out or discussed in class by the instructor will be part of course material and students will be responsible for studying them in addition to the prescribed sections of the text book.
• Homework/projects must be done on 8 ½" × 11" engineering calculation paper, in a manner consistent with professional engineering calculation in practice.
• **Electronic versions of homework will not be accepted**.
• Please keep a copy of all your work until you received a final grade.
• Please save a copy of your homework before submitting it to the instructor, since it may not be always possible for the instructor to return the corrected homework back in time for you to study for quizzes and examinations.
• All work should be done in a professional manner.
• Homework is due at the beginning of class. Late homework will incur a 50% deduction if handed in the same day, and 100% deduction after that. **Online submissions will not be accepted.**
• The instructor may photocopy and save your assignments and tests, as part of the effort necessary to renew accreditation of our educational programs. The copies, which will be accessible only to faculty, administration, and external reviewers, will be destroyed afterwards.
• No make-up examination will be administered.
• Switch off laptops and cell phones during quizzes and examinations. Plan on bringing a watch to keep time during examinations.
• No recording devices shall be used during class or examinations. Take notes.

**BASIS OF GRADING**

| | |
|---|---|
| Midterm Exam I | 25 points |
| Midterm Exam II | 25 points |
| Final Exam | 30 points |
| Homework | 10 points |
| Quizzes | 10 points |
| Total | 100 points |

| Final Score | Grade |
|---|---|
| Above 90 | A |
| 89-85 | B+ |
| 84-80 | B |
| 79-75 | C+ |
| 74-70 | C |
| 69-65 | D |
| 64 and Below | F |

**CE 341- Soil Mechanics - Spring 2019**

**Description:**

A study of soil types and properties is made with the objective of developing a basic understanding of soil behavior. The methods of subsurface investigation and compaction are presented. Fundamentals pertaining to permeability, seepage, consolidation, stress distribution, and sheer strength are introduced. Settlement analysis is also presented.

**Prerequisites:** Mech 237 - Strength of Materials **Co requisite** - CE 341A - Soil Mechanics Laboratory

**Course Objectives:**

1. Learn index properties of soils methods of soil classification and subsurface investigations.
2. Learn principle of seepage through porous media and effective stress.
3. Learn principles of consolidation and shear strength.

**Topics:**

Soil properties and Classifications

Compaction

Darcy's Law, Seepage and Flow Nets

Geostatic and Effective Stresses

Consolidation and Settlement

Subsurface Investigation, Sampling and Standard Penetration Test

Mohr Circle and Shear Strength

Direct Shear Testing, Unconfined Compression and Triaxial Testing

Slope Stability

**Schedule: (3-0-3)**

**Professional Component:** Engineering Topics

**Program Objectives Addressed:** 1, 2

**Prepared By:** Prof. Raghu

**Outcomes Course Matrix – CE 341- Soil Mechanics**

| Strategies, Actions and Assignments | ABET Student Outcomes (1-7) | Program Educational Objectives | Assessment Measures |
|---|---|---|---|
| **Student Learning Outcome 1: Identify the properties of soils and the basic principles of soil mechanics and develop the ability to apply these principles to solving problems in civil engineering.** | | | |
| Introduce index properties of soils and subsurface investigations. | 1 | 1 | Homework, quizzes and exams. |
| Explore subsurface methods of investigation in design. | 1 | 1, 2 | Homework, quizzes, and problem solving in class. |
| Discuss professional design practice. | 2, 7 | 1, 2 | Class discussions and problem solving. Quizzes and exams. |
| **Student Learning Outcome 2: Apply principles of seepage through porous media and effective stress.** | | | |
| Introduce basic concepts and flow through soils. | 1 | 1 | Homework, quizzes and exams. |
| Apply these principles to problem solving. | 1, 2 | 1 | Homework, quizzes, and problem solving in class. |
| Discuss application of these principles to engineering problems. | 2 | 1 | Class discussions and problem solving. Quizzes and exams. |
| **Student Learning Outcome 3: Apply principles of consolidation and shear strength.** | | | |
| Introduce consolidation theory and shear strength principles | 1 | 1 | Homework, quizzes, and exams. |
| Discuss analytical methods to solve different types of settlement problems. | 2 | 1 | Homework, quizzes, and problem solving in class. |
| Discuss professional design practice. | 2, 4 | 1, 2 | Class discussions, problem analyses, and problem solving. |

**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