**College of Engineering**

**Department of Civil Engineering**

# CE 581 Advanced Soil Mechanics

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| **Credit and Contact hours** | 3 / 3 (Lectures), 0 (Tutorials), 0 (Laboratory) |
| **Required, or Elective** | Required |
| **Course Description** | Stress-strain relations, elasticity equations, shear strength theories. Principles of effective stress in saturated and partially saturated soils. Classical plasticity theory, critical state concept. Geosynthetics (Types, properties, & function) |
| **Prerequisites or Co-requisites** | None |
| **Course Learning Outcomes** | Students completing this course successfully will be able to: |

| Course Learning Outcomes (CLOs) | *Related Student Outcomes (SO)* |
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| **CLO1.** Recognize and identify the most critical issues and challenges in soil Mechanics. K1 | **SO1** |
| **CLO2.** Characterize soil behavior using stress paths and soil models. K1 | **SO1** |
| **CLO3.** Determine the appropriate type of soil shear strength to be used for analysis and design of geotechnical structures (e.g slope, foundations, and earth retaining structures). S1 | **SO2** |
| **CLO4.** Apply current practical and theoretical knowledge of fundamental geotechnical engineering principles, concepts and technologies to solve related problems for building structures on soil in regional contexts. S1 | **SO2** |
| **CLO5.** Evaluate effects of submergence, partial draining boundaries, time-dependent loading and radial drainage on the consolidation properties of soil as well as time-rates of consolidation of compressible soils for a variety of engineering problems. S4 | **SO5** |
| **CLO6.** Demonstrate professional engineering and ethical values in assigned projects and assignments, with high academic integrity. V1 | **SO6** |

**Student Outcomes related to this Course**

SO 1 Recognize advanced engineering knowledge, concepts, and techniques to identify, interpret, and analyze complex and real-life engineering problems.

SO 2 Provide solutions for complex and real-life engineering problems through critical thinking and the use of modern engineering tools, and identify their impact on social, global, cultural, environmental, safety, and economic factors.

SO 5 Design novel advanced Civil Engineering systems and evaluate their performance, sustainability, and effectiveness for engineering practice and their impact in global, economic, environmental, and societal contexts

SO 6 Demonstrate scientific integrity, ethical responsibility, and academic values in scientific publications, research projects, and thesis work.

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| **Topics Covered** | **List of Topics** — **Related CLOs**<br>1. Introduction, Philosophy of Testing — **CLO 1**<br>2. Index Properties & Classification of Soils. — **CLO 2**<br>3. Compaction — **CLO 1,2**<br>4. Hydraulic Conductivity — **CLO 2,3**<br>5. Consolidation — **CLO 3,4,6**<br>6. Shear Strength of Granular Materials — **CLO 3,4,6**<br>7. Deformation & Modulus — **CLO 5,6**<br>8. Shear Strength of Cohesive Materials — **CLO 5,6**<br>9. Stress Paths and critical state soil mechanics — **CLO 1,5,6**<br>10. Special Topics — **CLO 1,2,6**<br>11. Geosynthetics (Types, properties, & function) — **CLO 1,2,6** |
| **Textbook(s) and Other Required Material** | • An Introduction to Geotechnical Engineering by Robert D. Holtz, William D. Kovacs, Thomas C. Sheahan, 2nd Edition. |
| **Grading System** | Midterm Exam 30%<br>Assignments 15%<br>Term Project 15%<br>Final Exam 40% |
| **Instructors** | Dr. Abdullah Abdulrahman A Almajed |
| **Date of Review** | November, 2024 |