CVEN 5708 Soil Mechanics
Course Syllabus and Schedule

Professor: **John S. McCartney, Ph.D., P.E.**
Office: ECOT 547
Office hours: Tuesday-Thursday 9:30-12 and Wednesday 10:00-12:00 (or by appointment)
E-mail: john.mccartney@colorado.edu

Class: Time: Fall 2013, Tuesday-Thursday 8:00-9:15 am
Room: ECCR 137

Reference:
Scott, R.F. (1963). Principles of Soil Mechanics. Addison Wesley, New York
Atikinson, J.H. and Bransby, P.L. (1978). Mechanics of Soils: An introduction to Critical State Soil Mechanics, McGraw-Hill. New York.
Lu, N. and Likos, W. (2004). Unsaturated Soil Mechanics. Wiley. New York.
Desai, C.S. and Siriwardane, H.J. (1984). Constitutive Laws for Engineering Materials: With Emphasis on Geologic Materials. Prentice-Hall. New York.
Taylor, R. (1995). Geotechnical Centrifuge Modeling. Blackie. London.
Terzaghi, K. (1943). Theoretical Soil Mechanics. John Wiley and Sons. New York.
Wood, D.M. (1990). Soil Behaviour and Critical State Soil Mechanics. Cambridge University Press. London.

Course Description:
This course covers theory and application of soil mechanics, which includes: small strain continuum mechanics, effective stress principle, constitutive models for soils, pore fluid flow and consolidation in saturated soils, overview of physical modeling (e.g., using a geotechnical centrifuge) and numerical modeling. Prereqs: CVEN 3708 and CVEN 3718 or equivalent introductory course in soil mechanics and geotechnical engineering.

Course Objective:
To obtain sufficient understanding of the principles of soil mechanics to be able to read a wide range of journal articles on the subject, and to form the basis for pursuing research in soil mechanics and geotechnical engineering.

Course Outline:

a. Introduction to Continuum Mechanics
   i. Equilibrium equations, static and dynamic
   ii. Stress, principal directions, invariants
   iii. Soil mechanics stress sign convention, Mohr circle, stress space concepts
   iv. Strain, principal directions, invariants, rotation, compatibility
   v. Plane strain, plane stress, and axisymmetric conditions
b. Effective Stress Principle
   i. Derivation of effective stress for different materials
   ii. Effective stress under drained, undrained and seepage conditions
   iii. Unsaturated conditions
c. Introduction to Flow and Consolidation in Saturated and Unsaturated Soils
   i. Derivation of coupled equilibrium equations for saturated soils
   ii. Classical solution methods (e.g., time factors, Fourier series) for consolidation
   iii. Steady-state and transient seepage in rigid and deformable soils
d. Constitutive Models for Soils in Drained and Undrained Conditions
   i. Linear isotropic and anisotropic elasticity
   ii. Viscoelasticity and nonlinear elasticity
   iii. Concept of plastic yielding
   iv. Failure criteria (Drucker-Prager, Tresca, Mohr-Coulomb, Lade, etc)
   v. Experimental stress paths
   vi. Classical plasticity theory
   vii. Critical state soil mechanics and Cam-Clay plasticity
   viii. Viscoplasticity
e. Limit Analyses
   i. Upper bound solutions (Plastic slipline analysis)
   ii. Lower bound solutions (Limit equilibrium)
f. Overview of Physical versus Numerical Modeling
   i. Geotechnical centrifuge modeling
   ii. Numerical modeling methods in geotechnical engineering

Course Grade Distribution

Homework	50%
Midterm Exam	25%
Final Exam	25%
Total	100%

Neatness

- As engineers, you should inherently be neat and organized. You should certainly strive for neat work because you will probably have to return to design calculations at a variety of times in your careers and if you cannot figure out your own work you could be in severe difficulty. On exams, I will not give credit for answers I cannot read and will not change grading based on subsequent verbal explanations. It is your responsibility to communicate effectively on exams and homework assignments.

Attendance

- Class attendance is in accordance with the published university course schedule.
- Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, please contact me at least two weeks in advance. See full details at http://www.colorado.edu/policies/fac_relig.html

Disability Policy

- If you qualify for accommodations because of a disability, please submit to your professor a letter from Disability Services in a timely manner (for exam accommodations provide your letter at least one week prior to the exam) so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities. Contact Disability Services at 303-492-8671 or by e-mail at dsinfo@colorado.edu.
- If you have a temporary medical condition or injury, see Temporary Injuries under Quick Links at Disability Services website (http://disabilityservices.colorado.edu/) and discuss your needs with your professor.

Classroom Behavior and Honor Code

- Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, color, culture, religion, creed, politics, veteran's status, sexual orientation, gender, gender identity and gender expression, age, disability, and nationalities. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records. See policies at:
  - http://www.colorado.edu/policies/classbehavior.html and at
  - http://www.colorado.edu/studentaffairs/judicialaffairs/code.html#student_code
- The University of Colorado Boulder (CU-Boulder) is committed to maintaining a positive learning, working, and living environment. The University of Colorado does not discriminate on the basis of race, color, national origin, sex, age, disability, creed, religion, sexual orientation, or veteran status in admission and access to, and treatment and employment in, its educational programs and activities. (Regent Law, Article 10, amended 11/8/2001). CU-Boulder will not tolerate acts of discrimination or harassment based upon Protected Classes or related retaliation against or by any employee or student. For purposes of this CU-Boulder policy, "Protected Classes" refers to race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, or veteran status. Individuals who believe they have been discriminated against should contact the Office of Discrimination and Harassment (ODH) at 303-492-2127 or the Office of Student Conduct (OSC) at 303-492-5550. Information about the ODH, the above referenced policies, and the campus resources available to assist individuals regarding discrimination or harassment can be obtained at http://hr.colorado.edu/dh/
- All students of the University of Colorado at Boulder are responsible for knowing and adhering to the academic integrity policy of this institution. Violations of this policy may include: cheating, plagiarism, aid of academic dishonesty, fabrication, lying, bribery, and threatening behavior. All incidents of academic misconduct shall be reported to the Honor Code Council (honor@colorado.edu; 303-735-2273). Students who are found to be in violation of the academic integrity policy will be subject to both academic sanctions from the faculty member and non-academic sanctions (including but not limited to university probation, suspension, or expulsion). Other information on the Honor Code can be found at http://www.colorado.edu/policies/honor.html and at http://honorcode.colorado.edu