Soil Mechanics
CVEN 5708, Fall 2011
TuTh 8:00-9:15am, ECCR 1B08

Instructor:
Prof. Richard Regueiro
ECOT 424 (phone: 303.492.8026) office hrs: MW 1-2:30pm
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Course Description:
The 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 (e.g., geotechnical centrifuge) and numerical modeling.

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, as well as provide a basis for pursuing research in soil mechanics.

Prerequisites:
CVEN 3708, 3718, or equivalent; introductory soil mechanics and geotechnical engineering.

Course Grading:

Problem sets	70%
Term paper	10%
Final exam (in-class, 12/15, 7:30-10:00am)	20%

Problem sets:
You can work together on problem sets but must hand in your own solutions. You are encouraged to try the problems yourself before working with other students.

Term paper:
Midway through the semester, you will select a journal article on soil mechanics, which you will review in detail. If there are equations, you must understand their derivation, and re-derive yourself, understanding all notation. If experimental data are presented, you must understand what is reported and how data are analyzed. You will write your own critical review paper of the journal article.

Final exam:
The final exam will be in-class and open book and open notes. It will be based on problem sets and material covered in class.

Primary Reference: in-class notes, and R.F. Scott, Principles of Soil Mechanics, pdf on culearn.

Other books on reserve in the Engineering Library: http://bit.ly/cven5708
- J.H. Atkinson, P.L. Bransby, Mechanics of Soils: An Introduction to Critical State Soil Mechanics, McGraw-Hill, 1978.
- R.O. Davis, A.P.S. Selvadurai, Plasticity and Geomechanics, Cambridge University Press, 2005.
- C.S. Desai, H.J. Siriwardane, Constitutive Laws for Engineering Materials: With Emphasis on Geologic Materials, Prentice-Hall, 1984.
- T.W. Lambe, R.V. Whitman, Soil Mechanics, SI Version, John Wiley & Sons, 1979.
- N. Lu, W. Likos, Unsaturated Soil Mechanics, Wiley, 2004.
- R. Nova, Soil Mechanics, Wiley, 2010.

- R.F. Scott, Principles of Soil Mechanics, Addison Wesley, 1963.
- K. Terzaghi, Theoretical Soil Mechanics, John Wiley and Sons, 1943.
- K. Terzaghi, R.B. Peck, G. Mesri, Soil Mechanics in Engineering Practice, John Wiley & Sons, 1996.
- H.F. Wang, Theory of Linear Poroelasticity with Applications to Geomechanics and Hydrogeology, Princeton University Press, 2000.
- D.M. Wood, Soil Behaviour and Critical State Soil Mechanics, Cambridge University Press, 1990.
- D.M. Wood, Geotechnical Modelling, Spon Press, 2004.

Course Outline (tentative):

1. *Introduction to Continuum Mechanics* (3 weeks)
    a. Equilibrium equations: static, and dynamic
    b. Stress, principal directions, invariants
    c. Soil mechanics stress sign convention, Mohr's circle, stress space concepts
    d. Strain, principal directions, invariants, rotation, compatibility
    e. Plane strain, plane stress, and axisymmetric conditions
2. *Effective Stress Principle* (2 weeks)
    a. Derivation of effective stress
    b. Effective stress under drained, undrained, and seepage conditions
3. *Constitutive Models for Soils in Drained and Undrained Conditions* (5 weeks)
    a. Linear isotropic and anisotropic elasticity
    b. Viscoelasticity
    c. Concept of plastic yielding versus catastrophic failure
    d. Experimental stress paths
    e. Classical plasticity (von Mises plasticity)
    f. Mohr-Coulomb, Drucker-Prager plasticity with cap and third invariant
    g. Cam-Clay elastoplasticity in the context of critical state soil mechanics
4. *Introduction to flow and consolidation in saturated soils* (4 weeks)
    a. Derivation of coupled equilibrium equations for saturated conditions
    b. Classical solution methods (e.g., time factors, Fourier series) for consolidation (coupled deformation and flow) in saturated soil
    c. Steady-state and transient seepage in rigid soil
5. *Overview of Physical versus Numerical Modeling* (1 week)
    a. Physical Geotechnical Centrifuge modeling
    b. Numerical modeling methods in geotechnical engineering

Honor Code:
Please refer to the following webpage: http://www.colorado.edu/policies/honor.html

Special considerations:
- If you have a disability and require special accommodations, please provide Prof. Regueiro with a letter from Disability Services outlining your needs. Refer to the webpage http://www.colorado.edu/disabilityservices
- If you have a conflict as a result of religious observances, please notify Prof. Regueiro at least 2 weeks in advance of the exam or assignment due date. http://www.colorado.edu/policies/fac_relig.html

Access to Bechtel Lab: Email the last 7 digits of your BuffOne ID to leeann.stevens@colorado.edu, if you do not currently have card swipe access to the Bechtel Lab in ECCE 157, 161.
http://www.cs.colorado.edu/department/maps/ecce1.html