SOS 5406

Soil and Water Chemistry

Distance Education Section

Instructor: Dr. Samira Daroub, Associate Professor

- UF Soil and Water Science Department
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Office hours: Always open. Please call or email.

Course Prerequisites: SOS 3022 or SOS 5050 (or equivalent); General Chemistry (CHEM 2046 or equivalent).

Credit Hours:3 credits

Times: Class is offered thru Distance Education Fall semester Odd years.

Enrollment Cap: 20

Delivery Method: Web

Out-of-state students should consult the UF Soil and Water Science Department Web site for current tuition information http://soils.ifas.ufl.edu/distance/

Online meetings /Chat sessions: Thursdays 6-7:30 pm. For an orientation how to use Breeze Live please visit http://mbreeze.ifas.ufl.edu/p67991485/ and http://soils.ifas.ufl.edu/distance/Connect_SWS_overview.pdf

Course Overview:
The course will cover the basic principles of soil and water chemistry. The class will cover the fundamentals principles of the properties of soil components and soil reactions that affect plant growth and environmental quality.

Course Requirements: Students must have an e-mail account, Internet access, access to a computer that meets the University of Florida computer standards, and purchase the following textbook: **Soil and Water Chemistry: An Integrative approach.** M. E. Essington. 2004. CRC Press ISBN 0-8493-1258-2

Course Web Site: http://lss.at.ufl.edu/ , Click on Vista, then University of Florida. Login using your Gatorlink username and password. If you are registered for the course, you will see it listed under MyWebCT. Students must login to class website within the first 2 weeks of class.

Required Text:

Soil and Water Chemistry: An Integrative approach. M. E. Essington. 2004. CRC Press ISBN 0-8493-1258-2

Supplemental Reading Materials

1. **The Chemistry of Soils.** G. Sposito.1989. Oxford University Press.
2. **Environmental Chemistry of Soils.** *M. McBride. 1994. Oxford University Press.*
3. **Soil Chemistry.** Bohn, McNeal, and O'Connor. 2001 3rd edition. John Wiley Publishers.
4. **Chemical Equibiria in Soils..** W.L. Lindsay. 1979. John Wiley and Sons.

Students Responsibilities

Students are expected to study the assigned text sections and lectures prior to lecture coverage in class. Students are expected to actively participate in class chat discussions. There are HW assignments almost every week.

Exams

There will be three lecture exams. Your final grade will be based on the cumulative score for the three lecture exams and home work assignments.

3 one hour exams = 75% of grade

Homework assignments= 25% of grade

~~Tentative Lecture outline~~
Fall 2007

Module I
Introduction: Soil Chemistry, Soil Solution & Soil Solids

Section 1: Introduction & Overview of Basic Chemical Principles

Definition of Soil Chemistry
Review of Chemical Principles Handout
Problem set 1: Review of Chemical Principles

Section 2: The Soil Solution

Lecture 1: Soil water sampling; Composition of soil solution
Activity concept, estimation of coefficients & measurements
Lecture 2: Water and ion water interactions
Lecture 3: Chemical Speciation (use of speciation programs-VMinteqA2)
Problem set 2-Speciation exercise.

Section 3: Soil Solids

Lecture 1: Elemental Composition of Soil
Soil Minerals
Primary minerals

Lecture 2: Soil Minerals

Secondary Minerals
Soil Organic Matter

Module II
Soil Chemical Reactions

Section 1: Ion Exchange

Lecture 1: Concept & Source
Methods of CEC Measurements
Quantitative Description of Cation Exchange
A. Cation Exchange Equations

Lecture 2: Quantitative Description of Cation Exchange
B. The exchange isotherm
Point of Zero Charge

Section 2: Adsorption Reactions

Lecture 1: Introduction and definition
Surface functional groups
Surface complexes
Adsorption reactions
Diffuse double layer
A. Gouy Chapman Model
B. Stern Theory

Lecture 2: Quantitative description of Adsorption
A. Adsorption Isotherms
Surface complexation models

Section 3: Precipitation and Dissolution Reactions

Lecture 1: Precipitation – Dissolution Equilibria
Kinetics of mineral precipitation & dissolution
Precipitation in the soil environment

Lecture 2: Unified phase diagram: construction & interpretation
Double function parameters
Co-precipitation of trace elements

Module III
Soil Chemical Reactions

Section 1: Soil Acidity

Lecture 1: Origin & Source
Classification of Soil Acidity

Aluminum Theory of Soil Acidity

Lecture 2: Buffer Ranges in Soils
Lime Requirements
Potential Hazards of Solid Acidification

Section 2: Oxidation Reduction Reactions

Lecture 1: Concept & Definitions
Thermodynamics Relationships
Redox Limits in Soils

Lecture 2: Oxidations-Reductions in Soils

A. The source of electrons
B. Electron acceptors in soil
C. Important redox couples in soils

Section 3: Salt Affected Soils

Lecture 1: Sources of Salinity and Alkalinity
Carbonate Equilibria

A. Sources of carbonates in the environment
B. Carbonate species found in solution
C. Equations to describe carbonate equilibrium
D. Carbonate equilibrium diagram.

Equations to describe the $CaCO_3$-CO_2-H_2O equilibria
Measures of salinity and alkalinity

Lecture 2: Clay Swelling and Dispersion
Effects of Salt degraded soils on plants
Reclamation of salt-degraded soils.