

Course syllabus and outline for SOIL 7130 SOIL CHEMISTRY

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Lecture Outline

1. GENERAL THEORY

- 1.1 Nature of chemical bonding
- 1.2 Size of atoms and ions in relation to their chemical properties
- 1.3 Chemical thermodynamics and ionic equilibria
- 1.4 Chemical kinetics
- 1.5 Acid-base theory
- 1.6 Oxidation-reduction reactions
- 1.7 Complexation reactions
- 1.8 Chemical periodicity in relation to biological function of the elements

2. CHEMICAL COMPOSITION OF SOILS

- 2.1 Crystalline components
- 2.2 Non-crystalline components
- 2.3 Spectroscopic investigations of solids and solution species
- 2.4 Chemistry of soil organic matter

3. SOIL SOLUTION CHEMISTRY

- 3.1 Fundamental solution chemistry of major chemical elements of soils
- 3.2 Ionic composition and concentration-activity relations in soil solution
- 3.3 Determination and application of the solubility product constant in soil solution
- 3.4 Sparingly soluble solids and cation exchange reactions in relation to conditions in soil solution
- 3.5 Soil solution composition in relation to mineral stability and nutrient status

4. SOIL SURFACE CHEMISTRY

- 4.1 Fundamentals of physical chemistry of surfaces
- 4.2 Origin of charge in soils and sediments
- 4.3 Exchange and selectivity of cations
- 4.4 Exclusion and retention of anions
- 4.5 Adsorption and polymerization of molecules

5. IMPACT OF CHEMISTRY ON SOIL AND ENVIRONMENTAL SCIENCES

- 5.1 Pedogenesis
- 5.2 Physical properties
- 5.3 Nutrient transformations
- 5.4 Environmental pollution and land resource protection

Textbooks

Various textbooks and compulsory articles in refereed publications will be recommended.

Evaluation

Term paper 30% Topic to be assigned

Take home assignments 15% - Various short assignments due one week after; reading assignments for discussion in class

Take home assignment with preparation of lecture to class 15%

Final 3-hr exam to be written in class to cover all the lectures 30%

Final Oral exam following theory 10%