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%