

**Soil Chemical Processes and Environmental Quality
Environment and Natural Resources ENR 5262, Autumn 2017**

INSTRUCTOR:

Dr. Nicholas T. Basta, Professor of Soil and Environmental Chemistry,
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TIME AND PLACE:

Lecture WF 9:10 to 10:05, Kottman Hall (KH) room 245
Lab F 10:20 to 12:20, Kottman Hall (KH), room 114

PREREQUISITE: Chem 121, and 122 or 125, or graduate standing, or permission of instructor.

CREDIT HRS: 3 (2 1-hr class; 1 2-hr lab).

COURSE DESCRIPTION:

A comprehensive study of soil biogeochemical processes relevant to food production, soil remediation and restoration. Emphasis is placed on soil and environmental chemical processes on human and ecological health, ecosystem function, and soil remediation. Water and soil solution chemistry; soil carbon/organic matter, soil minerals, precipitation/dissolution, adsorption reactions and models, redox chemistry, soil acidity. Restoration / remediation topics include of human and ecological contaminant exposure in soil-water systems; environmental fate of fertilizer, pesticides in agricultural soil; remediation of severely degraded coal mineland soils and water (acidity, other); remediation of salt degraded soil (i.e. surface impact from subsurface shale fracturing); remediation of contaminated (heavy metals, toxic organics) soil; restoration of urban soils. Laboratory component focuses on hands-on soil investigation /problem solving using wet laboratory soil analysis and analysis of results using modern techniques used for soil chemical investigations including U.S. EPA geochemical speciation models used to predict chemical reactions and chemical species in soil and aqueous environments.

COURSE OBJECTIVES:

After completion of this course, students should:

1. Have a comprehensive understanding of biogeochemical processes in soil systems (i.e., soil, water, air, biotic) that impact environmental quality
2. Understand soil remediation sciences based on environmental chemistry, human and ecosystem function (including food production).
3. Be able to perform a soil biogeochemical investigation using laboratory data using MINTEQA2 and evaluate impact on ecosystem function.

POLICIES, EXAMINATIONS AND GRADING

Midterm Exam	30%
Final Exam	30%
Problem sets, 4	15%
Laboratory Reports 5 reports	25%

Grading A 92-100; A⁻ 90; B⁺ 88; B 82-87; B⁻ 80; C⁺ 78; C 72-77; C⁻ 70; D⁺ 68; D 62-68; D⁻ 60; E < 60.

LABORATORY ATTENDANCE FOR THE ENTIRE 2 HR LAB PERIOD IS MANDATORY.

TOPICAL OUTLINE

Water and Soil Solution Chemistry

Equilibrium concepts; fugacity; chemical speciation in water; carbonates and CO₂. Soil and water chemical speciation and solute transport; bioavailability, free ion activity model.

Soil Chemical Processes and Revegetation / Remediation

Soil chemical processes affecting revegetation; Precipitation-dissolution reactions, solubility diagrams, soil organic matter reactions, adsorption reactions and models, soil chemical redox reactions.

Soil Remediation and Environmental Chemistry

Restoration / remediation topics include of human and ecological contaminant exposure in soil-water systems; environmental fate of fertilizer, pesticides in agricultural soil; remediation of severely degraded coal mineland soils and water (acidity, other); remediation of salt degraded soil (i.e. surface impact from subsurface shale fracturing); remediation of contaminated (heavy metals, toxic organics) soil; restoration of urban soils.

TEXTBOOKS:

None required

Course notes provided on Carmen.

Recommended Textbook References

Soil and Environmental Chemistry, 2nd ed. 2017. William F. Bleam. Academic Press, Cambridge, MA.
ISBN 978-0-12-804178-9

Soil and Water Chemistry: An integrative approach. 2004. Michael E. Essington, CRC Press, Boca Raton, FL.

Environmental Chemistry of Soils. 1994. M.B. McBride. Oxford University Press, New York.

Chemical Equilibria in Soils. 2003. W.L. Lindsay, Blackburn Press, Caldwell, NJ.

ACADEMIC MISCONDUCT STATEMENT

Academic misconduct as defined by the university (Faculty Rule 3335-31-02) will not be tolerated.

DISABILITY STATEMENT

Students with disabilities who need accommodations should see Dr. Basta during office or contact him by telephone (614-292-6282) or e-mail (basta.4@osu.edu) to make arrangements. Special needs must be discussed and arrangements made well in advance (preferably before the first week of class) of when arrangements to accommodate specific needs are required. Special accommodations may be arranged through the OSU Office of Disability Service, 098 Baker Hall, 113 W. 12th Ave.; Ph: 614-292-3307, <http://www.ods.ohio-state.edu/>