AGRO/ EMS 2051	Soil Science	Lecture 3	Lab 2	Credits 4

Course Descrption

Prerequisite: CHEM 1002, 1212 or equivalent.

Principles of soil science; properties of soils related to plant growth and the environment.

Biology, chemistry and physics of soils. Includes genesis and classification, as well as widely practical applications of the basic sciences to crop production and environmental protection or restoration --soil survey, fertility, salinity, erosion and chemical pollution.

Course Objectives

Students will know and understand:

1 General components of soil and master soil horizons.

2 Basis for assigning color and its biological and/or chemical significance; definition of texture, how it is measured (mechanical analysis and feel method), and its importance in crop production and to the environment; types of structure, how management affects it and its importance; definitions of density and porosity, how to measure these parameters, effects of management on them and their importance.

3 That the chemical and physical weathering of rock yields particulate geologic materials that are altered in composition and disposition by the four processes of soil formation, which, in turn are controlled by the five factors of soil formation --parent material, climate, living organisms, relief, and time; major subordinate horizons.

4 Classification of soil by the USDA system, Soil Taxonomy, including hierarchy of the system, types of diagnostic horizons, and pedogenesis underlying the first hierarchal level, the 12 soil orders.

5 Types of information in hardcopy and web-based soil surveys and how to use this information.

6 Concepts of soil water capillarity; components of soil water potential energy; moisture characteristic curve; soil water movement based on gravitational and matric-pressure potential, including the effect of hydraulic conductivity; effects of soil horizonation on water flow; traditional physical and biological definitions of soil water based on the moisture characteristic curve; chemical and physical factors affecting the shape of the moisture characteristic curve, thus amount of plant-available water.

7 Processes in the field hydrologic cycle; water conservation and use management, including aspects of drainage and irrigation engineering.

8 Composition of soil air, importance of soil aeration, use of redox potential to measure aeration level, and management of soil aeration; definitions and environmental importance of wetlands and hydric soils.

9 Factors affecting soil temperature, and daily and annual cycles of temperature.

10 General types of soil colloids, the structure and properties of layer aluminosilicates, including types of charge, the phenomena and basis of ion exchange, soil-specific capacities for cation and anion exchange (CEC and AEC), and importance of these chemical reactions.

11 Definition of pH, its importance, sources of H^+ and OH^-, pH buffering in soils, and how it is managed with base (e.g., lime) or acid (e.g., sulfur) amendments.

12 Effect of salinity on plant growth, definitions of saline, sodic and saline sodic soils, and reclamation strategies for soil with high salt or sodium content.

13 Relative numbers and biomasses of soil micro-flora and -fauna; rhizosphere effects on soil biology; types and importance of mycorrhizal fungi; important biochemical processes mediated by soil microfauna.

14 Carbon cycle and how alterations to it contribute to global climate change; decomposition rates of organic residues, including concepts of mineralization and immobilization, and factors affecting organic matter decomposition; composition of humus; importance of organic matter to crop production and environmental quality; composts and composting.

15 Nitrogen cycle, including mineralization and immobilization, ammonium fixation, ammonia volatilization, nitrification, nitrate leaching, denitrification, and biological N fixation; S cycle, including oxidation / reduction reactions, and environmental problems associated with S oxidation.

16 Phosphorus fertility limitations and the contrary problem of water quality degradation by P-induced eutrophication; fixation reactions of inorganic P, including factors affecting fixation; Importance of K to plants, sources of it and their relative plant-availability, excessive (luxury) uptake of K.

17 Micronutrient deficiencies and toxicities, including effects of pH and redox potential on availability of micronutrients; micronutrient fertilization, including salt and chelated forms, applied to soil or plant canopy.

18 Nutrient best management practices; types and uses of organic and inorganic fertilizers; Liebig concept of the limiting factor; nutrient management, including plant and soil analyses; fertilizer application methods; economic considerations.

19 Fate of organic and inorganic contaminants in the soil environment; sources of inorganic contaminants; remediation strategies, including bioremediation.

20 Accelerated water erosion, including environmental effects and economic costs; mechanics of water erosion, including types and use of USLE and related models in water erosion control; mechanics of wind erosion, including environmental and economic costs; mechanics of wind erosion, including types and use of WEQ and related models in wind erosion control.

Procedures to Evaluate Objectives

1. Written exams over lecture and lab materials.

2. Quizzes over specific lecture and lab topics.

Detailed Topical Outline

Lecture	Corresponding Labs
Introduction	
Physical Properties	Mechanical analysis by pipette method; particle density
	Bulk density, gravimetric water content, volumetric water content
Soil Formation	
Classification	Profile descriptions at two sites of contrasting parent materials
Soil Survey	Use of soil survey book
Soil Water	Measure saturated hydraulic conductivity
Field Hydrologic Cycle	
Aeration	
Temperature	

Lecture	Corresponding Labs
Colloidal Materials	Qualitative investigation of ion exchange and extraction of bases + acids for calculation of cation exchange capacity
pH Management	Qualitative investigation for presence of carbonates, assessing buffering, and quantitative determination of lime requirement
Salinity and Sodium	
Biology	Enumeration of colony forming using serial dilutions
Organic Matter	Extraction of humic and fulvic acids, and qualitative investigation of their behavior with respect to ion exchange and coagulation
Nitrogen and Sulfur	
Phosphorus and Potassium	
Micronutrients	
Nutrient Management	Mehlich 3 extraction for soil P, colorimetric analysis and use of results to make recommendations (includes N and K calculations)
Soil Pollution	
Water and Wind Erosion	

Course Materials

Text	The Nature and Properties of Soils, 12th, 13th or 14th Edition N.C. Brady and R.R. Weil
Lab Manual	Provided
Other Materials	http://www.agronomy.lsu.edu/courses/agro2051/index.htm

Topics by Date, including Exams and Quizzes

M	W	F
25 AUGUST Introduction **Lab 1 Texture**	**27** Introduction / Physical Properties	**29** Physical Properties Quiz 1 Introduction
1 SEPTEMBER **Labor Day Holiday**	**3** Physical Properties	**24** Soil Formation Quiz 2 Physical Properties
8 Soil Formation **Lab 2 Particle and Bulk Densities**	**10** Classification	**12** Classification Quiz 3 Soil Formation / Classification
15 Soil Survey **Lab 3 Classification**	**17** Soil Water	**7** Soil Water Quiz 4 Survey / Soil Water
22 Field Hydrologic Cycle **Lab 4 Soil Survey**	**24** Review Exam 1	**26** **EXAM 1 (Through Survey)**
29 Field Hydrologic Cycle **Lab 5 Hydraulic Conductivity**	**1 OCTOBER** Air and Temperature Quiz 5 Hydrology	**3** **Fall Holiday**
6 Air and Temperature **LAB EXAM 1**	**8** Review Exam 2	**10** **EXAM 2 (Through Air and Temperature)**
13 Colloidal Chemistry **Lab 6 Ion Exchange**	**15** Colloidal Chemistry	**17** Soil Reaction Quiz 6 Colloids
20 Soil Reaction **Lab 7 pH and Liming**	**22** Salinity	**24** Biology Quiz 7 Reaction / Salinity
27 Organic Matter **Lab 9 Organic Matter**	**29** Review Exam 3	**31** **EXAM 3 (Through Biology)**
3 NOVEMBER **Lecture and Lab Holiday**	**5** **Lecture Holiday**	**7** Organic Matter
10 Macronutrients (N, P, K, S) **Lab Holiday**	**12** Macronutrients	**14** Macronutrients Quiz 8 Organic Matter / Macronutrients
17 Micronutrients **Lab Make-Up, 1, 2, 4, 5, 6, 7 or 9**	**19** Review Exam 4	**21** **EXAM 4 (Through Micronutrients)**
24 Nutrient Management **Lab 10 Soil Fertility**	**26** Nutrient Management / Soil Pollution Quiz 9 Nutrient Management	**28** **Thanksgiving Holiday**
1 December Soil Pollution / Erosion **LAB EXAM 2**	**3** Erosion Quiz 10 Pollution / Erosion	**5** **MAKE-UP EXAM (1, 2, 3 or 4)**
8	**10** **EXAM 5 (Through Erosion + Cumulative)** **5:30 – 7:30**	

Most Important Stuff

Where Held

Lecture	134 Madison Sturgis
Lab	241 Madison Sturgis

Contact

Instructor	Lewis Gaston
Office	224 Madison Sturgis
Lab	232 Madison Sturgis
Phone	578-1323
e-mail	lagaston@agctr.lsu.edu
Hours	9:40 - 10:30 MW

Grading

Scale		*Components*	*Weight*
90	A	Lecture	
80	B		
70	C	Quizzes	10 %
60	D	Exam 1 – 4	45 %
Below	F	Exam 5	15 %
		Lab	
		Quizzes / Exercises / Participation	10 %
		Exam 1 – 2	20 %
		Total	100 %

Comments on Exams, Quizzes and Make-Ups

Lecture

Lowest (one) mid-semester exam (1 – 4) dropped.
ONLY ONE MAKE-UP EXAM AND IT IS ON THE LAST DAY OF CLASS.
Lowest two quizzes dropped.
NO MAKE-UP QUIZZES.

Lab

MAKE-UP EXAM TO BE ARRANGED WITH LAB INSTRUCTOR.

Other Important Stuff

Code of Student Conduct

It is the responsibility of all students to familiarize themselves with the Code of Student Conduct and other University rules and regulations governing student conduct and activities.

Academic Dishonesty

Academic dishonesty can result in probation, suspension, or expulsion from the course. For more information, refer to your handbook of responsibility in student university relationship or refer to the Code of Conduct that can be found in the Office of the Dean of Students website within the LSU home page.

Disabilities Statement

If you have special needs addressed by the Americans with Disabilities Act, please notify your instructor immediately for proper accommodations.