HARTNELL COLLEGE
COURSE OUTLINE

CC Approval: 05/07/2015
Board of Trustees: 06/02/2015
Last Revised: 03/19/2009

DESIGNATOR & NUMBER: ABT 90

COURSE TITLE: Soil Science

CREDIT UNITS: 3

FACULTY INITIATOR: Steven Triano

SEMESTER HOURS:

32.00 - 36.00	Lecture Contact Hours
48.00 - 54.00	Lab Contact Hours
0.00	Total Contact Hours
4.00	Total Out-of-Class Hours
0.00	Total Student Learning Hours

TOTAL CONTACT HOURS (BASED ON 16-18 WEEKS)

32.00 - 36.00	Lecture
48.00 - 54.00	Lab
0.00	By Arrangement Lab Hours (DHR)

GRADING BASIS:
Grade Only

PREREQUISITE:

COREQUISITE:

ADVISORY:

OTHER:

COURSE DESCRIPTION:
Provides a basic knowledge of the genetic, physical, chemical, and biological properties of soils. Explores principles involved in the interpretation of soils information for land use management, (including agricultural production and non-agricultural uses), and conservation. Includes a weekly laboratory activity.

COURSE OBJECTIVES:
Upon satisfactory completion of the course, students will be able to

1. analyze local soil quality as affected by human and natural activities.
2. explain local geographical features and their relationship to local soils.
3. evaluate parent rocks and other soil forming processes influence on local and global soils.
4. demonstrate the determination of the following soil physical properties: texture (two methods), use of textural triangle, bulk density, particle density, pore space, organic content, color, pH, structure, conductivity and reactivity.
5. demonstrate an understanding of the classification of local and global soil orders (i.e., soil taxonomy).
6. discuss and understand the importance of essential plant nutrients.
7. apply soil nutrient cycles to soil, plant, and soil organism relationships.
8. demonstrate an ability to use appropriate terminology professionally when discussing soils.
9. demonstrate practical soil management including soil conservation and sustainability.
10. analyze a soil's microbiological activity level.
11. demonstrate an understanding of a soil food web.
12. describe the features of a soil profile and relate such to soil management practices.
13. demonstrate how to read a soil map, explain the importance of soil mapping and how to locate a specific site using both township/range and GIS (Geographic Information Systems).
14. demonstrate how to determine a Soil Storie Index Rating and a Natural Resources Conservation Service land capability class.
15. describe the organic breakdown cycle of a soil and the role of organisms in soil physical and chemical properties.
16. evaluate a soil's water holding capacity, plant available water, properties and movement of water in soil.
17. assess and evaluate the anion and cation exchange capacity for a given soil.
18. interpret a soil nutrient analysis including percent base saturation.
19. demonstrate the use of the scientific method when validating and/or experimenting on the principles of soil science.

COURSE CONTENT:

I. The importance of soil
   - A. Function of soils in our ecosystem
   - B. Early agrarian societies and their soil management practices, including significant historical events
   - C. The soil as a natural body, an overview of its features and functions
   - D. The scientific aspects of soil science, applied research present and future

II. Formation of soils from parent materials
   - A. Parent rocks and their influence on soil
   - B. Factors influencing soil formation
   - C. Soil formation in action

III. Soil classification
   - A. Soil orders
   - B. Categories and nomenclature of soil taxonomy
   - C. Soil series and textural classes
   - D. Storie index and land capability classes

IV. Soil physical properties
   - A. Texture
   - B. Structure
   - C. Color
   - D. pH

E. Profile
F. Bulk density
G. Particle density
H. Pore space
I. Soil management as applied to physical properties

V. Interpretation and use of soil maps
A. Remote sensing tools for soil investigations
B. Satellite imagery
C. County soil survey reports and their utilization
D. Geographic Information Systems (GIS)

VI. Organic material and microbiology of soils
A. Influence of organic material in the soil complex
B. Composting
C. Diversity of soil organisms
D. Influence of soil microorganisms
E. The soil environment and organisms and organic matter
F. Soil nutrient cycles
G. Concept of a sustainable soil system

VII. Soil moisture
A. The hydrological cycle
B. The soil plant atmosphere continuum
C. Relation to texture, structure, and organic material in the soil
D. Retention and movement in the soil
E. Soil drainage
F. Irrigation requirements and practices in relation to soil
G. Water quality influence and assessment
H. Water conservation applications
I. Soil colloids
J. Properties and type of colloids
K. Genesis of soil colloids
L. Cation exchange capacity
M. Factors influencing the availability of micronutrient cations and anions
N. Soil analysis

VIII. Soil pH
A. Assessment
B. Management of acidic soils
C. Management and reclamation of saline-alkaline soils
D. Global soil quality as affected by human activities

LAB CONTENT:

I. Rocks & Minerals in Soil Formation
A. Elements and minerals
B. Hardness scale

II. Mechanical Analysis
A. Soil texture
B. Hydrometer usage and specific gravity
C. Calculating percent sand, silt and clay

III. Determining Soil Texture by Feel
A. Soil sampling
B. Sample preparation
C. Ribboning soil
D. Texture determination

IV. Soil Properties Related to Texture
    A. Bulk density
    B. Particle density
    C. Porosity
    D. Macropores vs micropores
V. Soil Moisture
    A. Percent moisture
    B. Water fractions
        1. Field capacity and capillary water
        2. Available water
        3. Hygroscopic water
VI. Field Study of Local Soils
    A. Soil formation
    B. Landscape position
    C. Soil horizons
VII. Chemical Soil Analysis: pH and ECE
    A. Measuring pH
    B. Adjusing pH
    C. Salt content and ECE
VIII. Chemical Soil Analysis: N, P & K
    A. Soil sampling
    B. Chemical analysis of primary macronutrients
    C. Total nutrient content vs available nutrients
IX. Fertilizer Materials
    A. Organic vs inorganic fertilizer sources
    B. Fertilizer composition
    C. Fertilizer forms
    D. Fillers
X. Fertilizer Recommendations
    A. Calculating recommendations
    B. Cost analyses
    C. Fertilizer mixtures
XI. Soil Organism Study
    A. Soil sampling
    B. Soil organisms
        1. Bacteria
        2. Actinomycetes
        3. Fungi
        4. Arthropods
        5. Nematodes
        6. Other
    C. Estimating soil organism populations
XII. Soil Organic Matter & Humus
    A. Measuring organic matter content
        1. Muffle furnace method
        2. NaOH method
    B. Impact of organic matter
        1. Soil sturucture
        2. CEC
        3. Nutrient availability
XIII. Decomposers in the Soil
    A. Comparison of decomposition rates among various decomposing materials
    B. Comparison of decomposition rates between clay and sandy soils
XIV. Soil Conservation & Mapping

A. Soil surveys and the Web Soil Survey
B. Map units
C. Soil capability classes

XV. Land Measurement & Legal Description
A. Township and range and the PLSS System
B. Longitude and latitude
C. Meets and bounds system
D. GPS technology

INSTRUCTIONAL METHODOLOGY:

Lecture
Lab Activity
Individual Assistance
Audiovisual (including PowerPoint or other multimedia)
Demonstration
Discussion
Group Activity
Requires a minimum of three (3) hours of work per unit including class time and homework.

METHODS OF EVALUATING OBJECTIVES OR OUTCOMES:

Methods of evaluation to determine if students have met objectives may include, but are not limited to the following:

CLASSROOM	EXPLANATION
Class Activity	Students prepare for and participate in class discussions.
Lab Activity	Students complete weekly lab activity, determine test results and answer related questions.
Written Assignments	Completion of lab questions and text assignments.

EXAMS	EXPLANATION
Comprehensive Final	Multiple choice and written answers.
Problem Solving	Determining conclusions from several of the lab activity.
Skill Demonstration	Demonstrate the use of soil testing equipment.
Objective Test	Multiple choice and written answers.

MINIMUM STUDENT MATERIALS:

Textbook(s) similar to:

Brady, Nyle C. *Elements of the Nature and Properties of Soils*. 3rd Ed, Pearson Education, 2009
Plaster, E.J.. *Soil Science and Management*. 6th Ed, Cengage, 2013
Dingus, Del D (Steven Triano Ed.). Soils Science Laboratory Manual. Cal Poly, San Luis Obispo, 12-01-2014.

COURSE ASSIGNMENTS

Examples of Reading Assignments

Elements of the Nature and Properties of Soils, 3rd ed.

Students will complete reading assignments in the required text (approx 25-50 pages per week).

Soils Science Laboratory Manual
Students will complete reading assignments in the laboratory manual (approx 5-10 pages per week).

Various internet articles will be assigned as appropriate.

Examples of Writing Assignments

Students will complete weekly short writing assignments related to the laboratory topics.

Examples of Outside Assignments

Students will be assigned follow-up questions each week related to the laboratory exercise.

Students will be assigned specific tasks to complete on the Web Soil Survey application, Natural Resources Conservation Service.

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