AGRI 60 Course Outline as of Fall 2019

CATALOG INFORMATION

Dept and Nbr: AGRI 60 Title: SOIL & PLANT NUTRITION
Full Title: Soil & Plant Nutrition
Last Reviewed: 4/22/2024

Units		Course Hours per Week		Nbr of Weeks	Course Hours Total	
Maximum	3.00	Lecture Scheduled	2.00	17.5	Lecture Scheduled	35.00
Minimum	3.00	Lab Scheduled	3.00	8	Lab Scheduled	52.50
		Contact DHR	0		Contact DHR	0
		Contact Total	5.00		Contact Total	87.50
		Non-contact DHR	0		Non-contact DHR	0

Total Out of Class Hours: 70.00 Total Student Learning Hours: 157.50

Title 5 Category:	AA Degree Applicable
Grading:	Grade Only
Repeatability:	00 - Two Repeats if Grade was D, F, NC, or NP
Also Listed As:	
Formerly:	AG 53

Catalog Description:
This course is an introduction to the science, ecology and management of soils. A key focus of the class is viewing soil health as the basis for ecological land management and discussing management practices to conserve and improve soils. Soil physical, chemical and biological properties and processes are all examined in detail through class lectures and discussion. The class laboratory focuses on evaluating soil health with field measurements, laboratory analyses, and calculations, including using soil testing to develop soil nutrient plans.

Prerequisites/Corequisites:

Recommended Preparation:
Eligibility for ENGL 100 or ESL 100

Limits on Enrollment:

Schedule of Classes Information:
Description: This course is an introduction to the science, ecology and management of soils. A key focus of the class is viewing soil health as the basis for ecological land management and discussing management practices to conserve and improve soils. Soil physical, chemical and

biological properties and processes are all examined in detail through class lectures and discussion. The class laboratory focuses on evaluating soil health with field measurements, laboratory analyses, and calculations, including using soil testing to develop soil nutrient plans. (Grade Only)
Prerequisites/Corequisites:
Recommended: Eligibility for ENGL 100 or ESL 100
Limits on Enrollment:
Transfer Credit: CSU;UC.
Repeatability: Two Repeats if Grade was D, F, NC, or NP

ARTICULATION, MAJOR, and CERTIFICATION INFORMATION:

AS Degree:	**Area**		Effective:	Inactive:
	C	Natural Sciences	Fall 2025	
	L5	Physical and Biological Sciences		
	C	Natural Sciences	Fall 2019	Fall 2025
CSU GE:	**Transfer Area**		Effective:	Inactive:
	B1	Physical Science	Fall 2019	
	B3	Laboratory Activity		
IGETC:	**Transfer Area**		Effective:	Inactive:

CSU Transfer:	Transferable	Effective:	Fall 1981	Inactive:
UC Transfer:	Transferable	Effective:	Fall 2025	Inactive:

CID:
CID Descriptor: AG - PS 128L Introduction to Soil Science
SRJC Equivalent Course(s): AGRI30

Certificate/Major Applicable:
Both Certificate and Major Applicable

COURSE CONTENT

Student Learning Outcomes:
At the conclusion of this course, the student should be able to:
1. Discuss the importance of soil health to ecosystem services.
2. Explain soil physical properties and their influence on plant growth.
3. Explain the importance of soil organic matter and soil structure and propose management practices that improve these soil properties.
4. Interpret a laboratory soil nutrient report for agricultural nutrient management.

Objectives:
At the conclusion of this course, the student should be able to:
1. Collect, prepare, and test a representative soil sample for a variety of crop and forest environments and landscape situations.
2. Compare the functions of the four physical components of soil: air, water, mineral solids, organic matter.
3. Compare USDA Web Soil Survey maps and data with actual soil conditions encountered in field observations.

4. Define and cite examples of the five soil-forming factors: parent material, climate, topography, living organisms and time.
5. Distinguish the attributes of the typical horizons within a soil profile.
6. Relate the importance of soil texture to water holding capacity, aeration, permeability to plant roots, and drainage characteristics of soils.
7. Analyze soil texture using "feel" method and classify soils by percent sand, silt and clay content using the soil textural triangle.
8. Explain the natural processes that result in the formation of soil aggregates and recommend practices that enhance or maintain good soil structure.
9. Summarize the cation exchange process in relation to plant nutrient availability.
10. Describe the sources of soil acidity.
11. Describe harmful effects of pH imbalances and recommend materials and methods for managing soil pH.
12. Categorize the major groups of soil microflora and microfauna and explain benefits supported by the soil food web.
13. Explain the beneficial significance of nitrogen-fixing bacteria and mycorrhizal fungi.
14. Explain mineralization and immobilization of nutrients.
15. Describe the role of soils in the global carbon cycle and select management practices that support carbon farming.
16. List the factors that influence decomposition and describe the process of decomposition of organic matter.
17. Analyze the nutrient content of synthetic and organic fertilizer materials and predict suitability and effectiveness of fertilizers for a variety of crops.
18. Define accelerated erosion by wind and water and describe control methods.

Topics and Scope:

I. Soils and Society
- A. Ecosystem services supported by soils.
- B. Material composition of a healthy soil.
- C. Soil health

II. Soil Profiles - Six Master Horizons
III. Soil Formation
- A. 3 Types of Rock
- B. Types of Weathering
- C. Factors of soil formation
- D. Parent material influence on soil formation
- E. Climate influence on soil formation
- F. Topography influence on soil formation
- G. Organisms influence on soil formation
- H. Time influence on soil formation
- I. Soil formation processes

IV. Soil Physical Properties
- A. Soil color
  - 1. Soil processes that influence color
  - 2. Munsell soil color system
- B. Soil Texture
  - 1. Size of primary soil particles
  - 2. Influence of texture on soil physical and chemical properties
- C. Soil Structure
  - 1. Aggregate hierarchy
  - 2. Chemical and physical processes involved in aggregation of soil

- 3. Biological processes involved in aggregation of soil
- 4. Management of soil tilth

D. Bulk density and compaction

V. Soil Classification

A. Soil taxonomy
B. Properties used to classify soils
C. Diagnostic horizons
D. Soil orders: characteristics and geography
E. Soil series: definition and Official Series Description (OSD)
F. Soil survey
G. Digital soil mapping
H. Web soil survey

VI. Soil Water Dynamics

A. Structure of water molecule
B. Cohesion and adhesion
C. Water potential
D. Soil water availability and status
- 1. Field Capacity
- 2. Permanent Wilting Point (PWP)
- 3. Available water capacity

E. Infiltration

VII. Soil and the Hydrologic Cycle

A. Hydrologic cycle
B. Watersheds
C. Factors influencing water infiltration and runoff in soils
D. Saturated hydraulic conductivity
E. Septic systems
F. Subsurface drainage methods

VIII. Soil Colloids

A. Properties of colloids
B. Structure of clay molecules
C. Surface charge of clays
D. 1:1 and 2:1 clays
E. Cation exchange capacity

IX. Soil Acidity and Alkalinity

A. pH scale
B. Processes that contribute to soil acidity
C. Processes that contribute to soil alkalinity
D. Pools of soil acidity
E. Buffering capacity
F. Management of acidity with lime
G. Salinization of dryland soils

X. Nutrient Cycles and Soil Fertility

A. Essential plant nutrients
B. Nitrogen cycle
C. Nitrification and denitrification
D. Management of soil nitrogen
E. Biological Nitrogen fixation
F. Haber Bosch process
G. Phosphorous cycle
H. Phosphorous fixation in soils
I. Phosphorous management

J. Soil fungi and Phosphorous
K. Potassium cycle
L. Potassium management
M. Micronutrients

XI. Nutrient Management
A. Nutrient management plan
B. Ecological problems associated with nitrogen and phosphorous
C. Tools for field nutrient monitoring
D. Diagnosing nutrient deficiencies in crop plants
E. Riparian buffers

XII. Soil Erosion and Conservation
A. Land degradation: extent and causes
B. Process of soil erosion by water
C. Types of soil erosion by water
D. Factors that influence rate of soil erosion by water
E. Process of soil erosion by wind
F. Management of soil cover by vegetation and crop resides
G. Soil conservation practices

XIII. Soil Organisms and Ecology
A. Quantities of soil organisms
B. Soil food web
C. Types of soil organisms and their ecological roles
D. Benefits to agriculture provided by soil food web
E. Effect of soil management practices on organisms

XIV. Soils and the Carbon Cycle
A. Global carbon cycle
B. Pools, fluxes, and residence time in carbon cycle
C. Role of soils in generating carbon emissions
D. Effect of cultivation on soil carbon
E. Factors affecting decomposition of plant residues
F. Types and pools of soil carbon
G. Carbon Farming
H. Potential of land management to offset greenhouse gas emissions

XV. Laboratory Topics
A. Scientific method applied to soils and agriculture
B. Collecting and processing soil samples from field for nutrient management
C. Calculating land area
D. Conversion of units
E. Web Soil Survey
F. Munsell soil color chart
G. Texture by “feel” method
H. Water infiltration with USDA Natural Resources Conservation Service (NRCS) method
I. pH and liming of soil
J. Fertilizer grades and nutrient content
K. Calculating fertilizer application rates
L. Interpreting a laboratory soil nutrient test
M. Bulk density
N. Land evaluation
O. Visual soil assessment
P. Interpretation of soil property data under different land uses

Assignment:

Lecture-Related Assignments:
1. Weekly text reading assignments of approximately 20-40 pages per week
2. Quizzes on text reading (10 – 15)
3. Web soil survey report
4. Mid-term and final exams

Lab-Related Assignments:
1. Weekly laboratory practicals (10 - 15)
2. Calculation problem sets (3 - 5)

Methods of Evaluation/Basis of Grade:

Writing: Assessment tools that demonstrate writing skills and/or require students to select, organize and explain ideas in writing.

Lab practicals and web soil survey report	Writing 10 - 20%

Problem Solving: Assessment tools, other than exams, that demonstrate competence in computational or non-computational problem solving skills.

Lab practicals and calculation problem sets	Problem solving 20 - 40%

Skill Demonstrations: All skill-based and physical demonstrations used for assessment purposes including skill performance exams.

None	Skill Demonstrations 0 - 0%

Exams: All forms of formal testing, other than skill performance exams.

Quizzes, midterm, final exam: Multiple choice, True/false, Matching items, Completion	Exams 30 - 60%

Other: Includes any assessment tools that do not logically fit into the above categories.

Lab participation	Other Category 10 - 20%

Representative Textbooks and Materials:
Elements of the Nature and Properties of Soils. 4th ed. Brady, Nyle and Weil, Raymond. Pearson. 2019
Soil Science Simplified. 5th ed. Franzmeier, Donald and McFee, William and Graveel, John. Waveland Press. 2016