LSC Use Only No:	LSC Action-Date:	UWUCC USE Only No.	UWUCC Action-Date:	Senate Action Date:
		04-37	Appr 3/22/05	Appr 4/26/05 & 10/4/05

Curriculum Proposal Cover Sheet - University-Wide Undergraduate Curriculum Committee

Contact Person	Email Address
Michael A. Poage	mpoage@iup.edu
Proposing Department/Unit	**Phone**
Geosciences - Natural Sciences and Mathematics	724-357-5627

Check all appropriate lines and complete information as requested. Use a separate cover sheet for each course proposal and for each program proposal.

1. Course Proposals (check all that apply)

_X_ New Course _____ Course Prefix Change _____ Course Deletion

_____ Course Revision _____ Course Number and/or Title Change _____ Catalog Description Change

	GEOS 333 Soils and Soil Geochemistry
***Current* Course prefix, number and full title**	***Proposed* course prefix, number and full title, if changing**

2. Additional Course Designations: check if appropriate

_____ This course is also proposed as a Liberal Studies Course.

_____ This course is also proposed as an Honors College Course.

_____ Other: (e.g., Women's Studies, Pan-African)

3. Program Proposals

_____ Catalog Description Change _____ Program Revision

_____ New Degree Program _____ Program Title Change _____ Other

_____ New Minor Program _____ New Track

***Current* program name**	***Proposed* program name, if changing**

4. Approvals		**Date**
Department Curriculum Committee Chair(s)	Darlene Richard	10/25/04
Department Chair(s)	Darlene Richard	10/25/04
College Curriculum Committee Chair		11/19/04
College Dean	John D. Eck	11-28-04
Director of Liberal Studies *		
Director of Honors College *		
Provost *		
Additional signatures as appropriate: (include title)		
UWUCC Co-Chairs	Gail S. Sechrist	3-22-05

* where applicable

Part II. Description of Curricular Change

1. SYLLABUS OF RECORD

I. Catalog Description

GEOS 333 Soils and Soil Geochemistry

Prerequisite: GEOS 220

2 class hours
3 lab hours
3 credit hours

(2c-3l-3cr)

An introduction to the formation, classification and geochemistry of soils. Emphasizes geology, climate, hydrology, and plant-soil interactions to investigate soil evolution and fertility, nutrient dynamics and the role of soils in the global carbon cycle. Laboratory topics include assessment of soil structure, mineralogy, chemistry and fertility as well quantitative treatment of carbon cycling in soils. Includes field trips which may occur on weekends.

II. Course Objectives

At the end of this course students will be able to:

1) Explain the nature and importance of soils in both the world ecosystem as well as human society.

2) Demonstrate an understanding of rock and mineral weathering and the formation of soil as the interface between bedrock, the atmosphere and the hydrosphere.

3) Demonstrate knowledge of the principles of soil classification and the physical and chemical characteristics of the most important soil types, as well as the climates in which they form.

4) Demonstrate knowledge of soil fertility including an understanding of cation and anion exchange, soil pH, and buffering capacity.

5) Explain the fundamentals of the global carbon cycle, the greenhouse effect and the role of soil organic matter in the carbon cycle and global warming.

6) Demonstrate knowledge of elemental cycling in soils including the carbon, nitrogen, sulfur, phosphorus, and potassium cycles.

7) Through laboratory exercises, be able to describe and identify different soil types, perform basic measures of soil mineralogy, chemistry and fertility, and calculate theoretical nutrient and organic matter depth profiles for steady state soil conditions.

III. Course Outline

Lecture

Part A (7 hours): Physical Characteristics of Soils

1. Introduction to soils, functions of soils in our ecosystem, soil water, soil organic matter, soil nutrients and soil quality
2. Formation of soils from parent material, weathering, evolution of the soil profile
3. Classification of soils, influence of climate on soil structure and chemistry
4. Soil architecture, soil texture and density, formation and stabilization of soil aggregates, tillage and its effects on aggregation

Exam 1 (1 hour)

Part B (4 hours): The Soil Environment

1. Soil water, infiltration and percolation, soil moisture, evaporation and water vapor movement in soils
2. Soil aeration, oxidation-reduction potential in soils, ecological effects of soil aeration, wetlands and poorly aerated soils
3. Soil temperature and its effects, absorption and loss of solar energy, thermal properties of soils

Part C (8 hours): Soil Mineralogy and Chemistry

1. Weathering and soil minerals, soil colloids and clay minerals, geographic distribution of soil colloids, physical implications of swelling clays
2. Charged surfaces on soil colloids, adsorption of cations and anions, cation exchange reactions and cation exchange capacity, anion exchange and sorption of organic compounds
3. Soil acidity, buffering of soil pH, determination of soil pH, development of salt affected soils, measuring soil salinity, plant growth in saline soils, reclamation of saline soils

Exam 2 (1 hour)

Part D (7 hours): Elemental Cycling in Soils

1. The global carbon cycle, decomposition of organic matter in soils, humus formation, carbon cycling in soils, soils and the greenhouse effect
2. Nitrogen and plant growth, origin of soil nitrogen, nitrogen cycling and dynamics in soils
3. Soil sulfur sources, behavior of sulfur compounds, sulfur cycle in soils
4. Phosphorus and plant nutrition, organic vs. inorganic phosphorus in soils, phosphorus fixation in soils, phosphorus cycling in soils
5. Potassium and plant nutrition, forms and availability of soil potassium, potassium and soil fertility, potassium cycling in soils

Final exam during final exam period.

Laboratory Exercises

Week 1: Soil Description and Classification I
Week 2: Soil Description and Classification II
Week 3: Particle-Size Analysis
Week 4: Soil Density and Porosity
Week 5: Soil Water and Moisture
Week 6: Soil pH and Salinity
Week 7: Soil Mineralogy - Microscopic Analysis
Week 8: Soil Mineralogy - X-ray Analysis
Week 9: Cation Exchange Capacity Measurement
Week 10: Field Trip: Salt-affected Soils
Week 11: Soil Organic Matter - Concentration
Week 12: Soil Organic Matter - Carbon Isotope Ratios
Week 13: Soil Organic Matter - Computer Modeling
Week 14: Presentation of Soil Organic Matter Project

The first four labs involve the characterization and classification of soils as well as quantitative determination of some important physical properties of soils. Labs 5-10 involve quantitative measurement of mineralogical and chemical properties of soils including an investigation of the effect of soil salinity on cation exchange capacity. The final four labs compose a project involving measurement of soil organic matter concentrations and carbon isotope ratios, computer modeling of these data in terms of organic matter dynamics in soils, and student write-up and presentation of findings.

IV. Evaluation Methods

The final grade for this class will be determined as follows:
Exam 1 (15%): The first exam will be held during the fifth week of the semester and will cover introductory material, the formation of soils from parent rocks, soil classification and architecture.

Exam 2 (15%): The second exam will be held in the tenth week of the semester and will cover soil water, soil aeration and temperature, soil mineralogy/colloids and cation exchange capacity, and soil pH, alkalinity and salinity.

Final Exam (25%): This will be a cumulative final exam and include material covered on the first two exams as well as soil organic matter, and elemental cycling (carbon, nitrogen, sulfur, phosphorus, potassium and selected micronutrients) in soils.

Laboratory Exercises (25%): Each week's laboratory exercise will be handed in as a written report including documentation of procedures, data collected and interpretation.

Write-up and Presentation of Lab Project (10%): As part of the laboratory section of the class, students will engage in a group project involving measurement of soil organic carbon concentrations and $^{13}C/^{12}C$ isotope ratios in depth profiles to place constraints on soil carbon dynamics.

In-class Quizzes and Exercises (10%): There will be periodic in-class quizzes and exercises throughout the semester.

The final grade for this course will be determined according to the following schedule:
A=90-100%; B=80-89%, C=70-79%, D=60-69%, F=<60%

V. Attendance Policy
The attendance policy will conform to IUP's undergraduate course attendance policy.

VI. Required textbooks, supplemental books and readings
Brady, N.C. and Weil, R.R. (2004) Elements of the Nature and Properties of Soils, Upper Saddle River, New Jersey: Prentice Hall.

Approximately ten research articles will be selected from the current and past scientific literature to highlight historic contributions and current issues in soil science. Examples might include:

Simonson, R.W. (1958) Outline generalized theory of soil genesis: Soil Science Society of America Proceedings, v. 22, p. 152-156.

van Breeman, N. and Finzi, A.C. (1998) Plant-soil interactions: Ecological aspects and evolutionary implications: Biogeochemistry, v. 42, p. 1-19.

Six, J., Elliot, E.T. and Paustian, K. (2000) Soil structure and soil organic matter II. A normalized stability index and the effect of mineralogy: Soil Science Society of America Journal, v. 64, p. 1042-1049.

Likens, G.E., Driscoll, C.T. and Buso, D.C. (1996) Long-term effects of acid rain: Response and recovery of a forest ecosystem: Science, v. 272, p. 244-246.

Weil, R.R. (2000) Soil and plant influences on crop response to two African phosphate rocks: Journal of Agronomy, v. 92, p. 1167-1175.

The following will be held on reserve as supplemental reading:
Singer, M. J. and Munns, D. N. (2002) Soils: An Introduction (5^{th} ed.), Upper Saddle River, New Jersey: Prentice Hall.

VII. Special resource requirements
There are no special resource requirements for this course.

VIII. Bibliography
Bouwman, A.F. (1990) Soils and the Greenhouse Effect, Chichester, U.K.: Wiley and Sons.

Brady, N.C. and Weil, R.R. (2004) Elements of the Nature and Properties of Soils, Upper Saddle River, New Jersey: Prentice Hall.

Buol, S.W., Hole, F.D., McCraken, R.J. and Southard, R.J. (1997) Soil Genesis and Classification (4th ed.), Ames, Iowa: Iowa State University Press.

Coleman, D.C. and Crossley, D.A. (1996) Fundamentals of Soil Ecology, San Diego, CA: Academic Press, Inc.

Dixon, J.B. and Schulze, D.J. (2002) Soil Mineralogy with Environmental Applications, Madison, Wis.: Soil Science Society of America.

Fanning, D.S. and Fanning, M.C.B. (1989) Soil: Morphology, Genesis, and Classification, New York: Wiley and Sons.

McBride, M.B. (1994) Environmental of Soils, New York: Oxford University Press.

McCarthy, D.F. (1993) Essentials of Soil Mechanics and Foundations (4th ed.), Englewood Cliffs, New Jersey: Prentice Hall.

Richter, D.D. and Markewitz, D. (2001) Understanding Soil Change, Cambridge, U.K.: Cambridge University Press.

Singer, M. J. and Munns, D. N. (2002) Soils: An Introduction (5th ed.), Upper Saddle River, New Jersey: Prentice Hall.

In addition, many scientific articles will be used from peer-reviewed journals including:

Advances in Agronomy
Geoderma
Global Biogeochemical Cycles
Soil Science Society of America Journal
Journal of Agronomy
Soil Science
Journal of Environmental Quality
Agriculture, Ecosystems and Environment

Course Analysis Questionnaire

Section A: Details of the Course

A1. This course is one of the controlled electives offered to students pursuing BS degrees in either Geoscience-Geology Track or Geoscience-Environmental Geoscience Track. This course is not a Liberal Studies course. The content of this course reflects growing recognition of the importance of soils within the greater geoscience community. Although the content of the course will draw on some material covered more superficially in other Geoscience courses [GEOS 220 Mineralogy; GEOS 332 Geochemistry], this course is directed specifically to the application of such material to soil science. The amount of material specific to soil science is far too extensive to be successfully incorporated into these other classes.

A2. This course does not require changing the existing content of any other courses or requirements for any program.

A3. This course has never been offered in the Geoscience Department, and to the best of my knowledge has not been offered in any other department.

A4. This course is not a dual-level course.

A5. This course cannot be taken for variable credit.

A6. Virtually all land-grant institutions offer courses similar to this in their agriculture schools. Examples include:

Pennsylvania State University: Soils 101 Introduction to Soils
University of Idaho: Soil 205 Introduction to Soils; Soil 206 General Soils Laboratory

In addition, many universities are also offering soils and/or soil geochemistry courses outside of agriculture schools. Examples include:

Princeton University: GEO 470 Environmental Geochemistry of Soils
Dartmouth College: EARS 79 The Soil Resource
University of California, Berkeley: ESPM 122 Soil Formation and Biogeochemistry

A7. No professional society, accrediting authority, law or other external agency recommends or requires any specific content or skills for this course.

Section B: Interdisciplinary Implications

B1. This course will be taught by one instructor from the Geoscience Department.

B2. There is no direct overlap between the content of this course and that of other courses currently offered in other departments. BIOL 272 Conservation of Plant and Animal Resources and GEOG 440 Conservation: Environmental Analysis address issues of soil conservation. The content of this proposed course does not include soil conservation, but rather focuses on the physical and chemical processes of soil development, the chemistry of soil fertility and the biogeochemical dynamics of soils.

B3. This course will not be cross-listed with any other department.

B4. Seats in this course may be available to students in Continuing Education provided they have the prerequisite.

Section C: Implementation

C1. Faculty resources are currently adequate to teach this course. Dr. Poage will incorporate this course into his rotation of introductory and upper-level courses currently being taught. This course will be counted as one preparation and five hours of equated workload.

C2. a. With the recent completion of renovations to Weyandt 133 (Dr. Poage's Geochemistry Laboratory) coupled with Geoscience Department teaching laboratory space (Walsh 101, Walsh 108), all space required to conduct both the lecture and laboratory portions of this class is currently available.

b. Equipment resources required to complete the laboratory section of the class include standard items such as a pH meter, a conductivity meter, a drying oven, glassware etc. As the content of the laboratory exercises meshes very closely with Dr. Poage's research activities, these items are available for use in the newly established geochemistry laboratory in Weyandt 133.

c. There will be small amounts of consumable supplies required for the laboratory portion of the class. These would include common reagents for chemical procedures (i.e. Potassium Chloride, Hydrogen Peroxide, Hydrochloric Acid etc). These are either already available in the geochemistry lab or are sufficiently inexpensive that they can be covered by the department budget.

d. Library materials are currently adequate for this course.

e. There will be no additional travel expenses.

C3. No resources for this course are currently funded by a grant.

C4. The department expects that this course will be offered every other year as are most of the Geoscience Department's 300-level courses. There are no absolute seasonal restrictions, however fall semester would be preferable as the ground is not likely to be frozen for the majority of the semester.

C5. We anticipate offering a single section of this course in a given semester.

C6. We plan to accommodate no more than twenty-four students in a section of this course. This is the maximum number of students that can be accommodated in the Geoscience Department's teaching laboratory rooms.

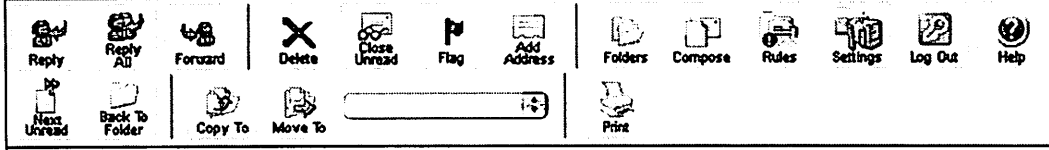
C7. No professional society recommends enrollment limits or parameters for this course.

C8. Not applicable.

Section D: Miscellaneous
None.

Part III. Letters of Support or Acknowledgment
Attached are copies of e-mails sent to Drs. Sechrist (Geography) and Luciano (Biology) regarding courses taught in their respective departments with which the proposed course may overlap. We have received a support letter from the Biology Department (attached).

IUP I-Mail: ⏏ Message from Sent Items Folder



From: "Michael A Poage" <mpoage@iup.edu>
Subject: New Geoscience Course Proposal
Date: Mon, 11 Oct 2004 16:15:44 -0400
To: rpsecrst@iup.edu

Dr. Sechrist:

I am in the process of proposing a new course in the Geoscience Dept. entitled Soils and Soil Geochemistry (GEOS 333). Enclosed as an attachment is the course proposal as it currently stands. I have perused the course catalog for classes with which this proposed course may overlap and found GEOG 440 Conservation: Environmental Analysis to be among the few courses that address soil issues. As my proposed course does not address soil conservation per se, I do not immediately see overlap here. However, I wanted to confirm this with you and hopefully resolve any conflict that might arise. If in fact, you or faculty in your department see no significant overlap, I was hoping you could provide a short e-mail letter of support to include with the proposal.

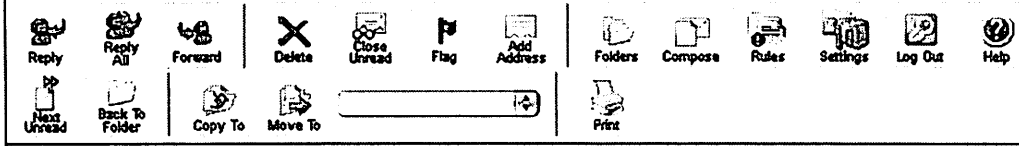
Thank you very much. If you have any questions or need more information please let me know.

Sincerely,

Michael Poage
Geoscience Department

Attachment: Soils Course Proposal.doc (41Kbytes)

IUP I-Mail: ⏏ Message from Sent Items Folder



From: "Michael A Poage" <mpoage@iup.edu>
Subject: New Geoscience Course Proposal
Date: Mon, 11 Oct 2004 16:12:09 -0400
To: luciano@iup.edu

Headers
Decode

Dr. Luciano:

I am in the process of proposing a new course in the Geoscience Dept. entitled Soils and Soil Geochemistry (GEOS 333). Enclosed as an attachment is the course proposal as it currently stands. I have perused the course catalog for classes with which this proposed course may overlap and found BIOL 272 Conservation of Plant and Animal Resources to be among the few courses that address soil issues. As my proposed course does not address soils conservation per se, I do not immediately see overlap here. However, I wanted to confirm this with you and hopefully resolve any conflict that might arise. If in fact, you or faculty in your department see no significant overlap, I was hoping you could provide a short e-mail letter of support to include with the proposal.

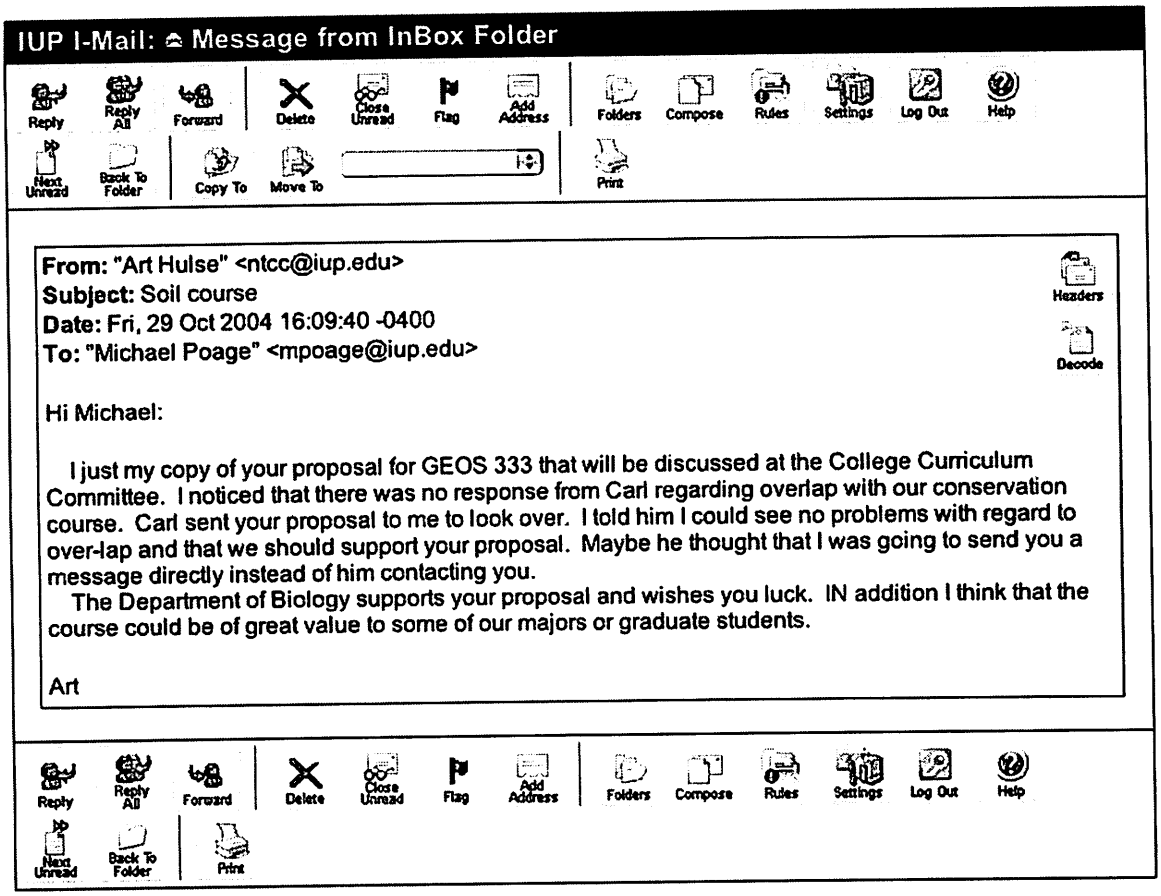
Thank you very much. If you have any question or need more information please let me know.

Sincerely,

Michael Poage
Geoscience Department

Open File

Attachment: Soils Course Proposal.doc (41Kbytes)



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