METROPOLITAN STATE COLLEGE OF DENVER
Omnibus Course Syllabus

School of Letters, Arts, and Sciences

Department: Earth & Atmospheric Sciences
Instructor: Robert Leitz

Prefix and Course Number: ENV 150

Banner Number (for Academic Affairs use):

Semester offered: Summer, 2003

Course Title: Colorado Wildfires

Credit Hours: 2

Contact Hours-students: 30
Total Other Hours*:
Contact Hours-faculty:

Meeting Times/Dates: Tuesday, and Thursday, July 22 & 24, and Thursday, July 31, 5:30-8:30
PM. Field lecture: Friday, Saturday, and Sunday, July 24, 25, & 26, 23:35 & 37.

Grading Mode(s): L
Schedule Type(s): L

Prerequisites/Corequisites:

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Required Reading Materials (author, title, publisher, copyright date):

Handouts provided by instructor.

Evaluation of Student Performance:

Final Exam and summary field-trip report

Specific (measurable) Student Behavioral Learning Objectives:

Upon completion of this course the student will be able to:

1. describe the impact of the 2002 “Big Fish” wildfire on the Flattops Wilderness Area.
2. understand and discuss before and after fire effects on:
   a. lacustrine (lake) environment
   b. fluvial (stream) environment
c. flora and fauna habitats.
d. human habitats.
3. measure and compare rates of erosion in burn versus non-burn regions.
4. compile a reconnaissance burn map.
5. use a Brunton compass to collect and locate data.
6. use a Garmin 12 GPS unit to collect spatial data.
7. collect samples of fire produced hydrophobic soils.
8. discuss economic impact of wildfires.

Detailed outline of course content (major topics and subtopics) or outline of field experience/internship (experience, responsibilities and supervision):

I. Classroom lectures
   A. General course objectives
   B. Basic geologic principles and vocabulary to be used to describe the Flattops region
      i. 1. Uniformitarianism
      ii. 2. Geologic time
      iii. 3. Plate tectonics
      iv. 4. Igneous processes and products
   C. Basic geographic outline of the Flattops/White River Plateau region
   D. Conditions leading to the “Big Fish” wildfire
   E. Field sampling procedures
   F. Field equipment to be used
   G. Trip logistics

II. Field lectures and exercises
   A. Regional geology/geography
   B. Pre-burn/post-burn regional flora/fauna
   C. Pre-burn/post-burn alpine soils
   D. Measuring erosion rates in burn/non-burn areas
   E. Rates of flora recovery.
   F. Future wildfire management

III. Course requirements
   A. Field trip exam
   B. Summary field trip report

Approved - Omnibus course:

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<th>Dean of School</th>
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COURSE CROSSTILING AGREEMENT FORM
The Metropolitan State College of Denver

This is to confirm that the undersigned have met, discussed, and agreed that the following course be crosslisted as follows:

Original/Standing Course:

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<td>Colorado Wildfires</td>
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Course to be crosslisted with (one or more courses):

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beginning Summer, 2003 (semester and year).

Approved:

Department Chair/Institute Director

Approved: 1/10/03

Department Chair/Institute Director

Approved: 1/10/03

Dean

Approved: 1/16/03

V. P. for Academic Affairs

Approved: 1/16/03

Please forward the completed form to the Office of Academic Affairs for processing and recordkeeping (CN 318, Box 48). It will remain in force until rescinded by one of the parties using the Crosslisting Termination Form.
REGULAR COURSE SYLLABUS

School of: Letters, Arts, and Sciences

Department: Earth and Atmospheric Sciences

Prefix & Course Number: ENV 1200  Crosslisted With*:  

Course Title: Introduction to Environmental Science

Check All That Apply: Required for Major: X  Required for Minor: X  Specified Elective: X  
Required for Concentration:  Elective: X  Service Course: X

Credit Hours: 3 (3+0)

Total Contact Hours per semester (assuming 15-16 week semester):
Lecture 45  Lab 0  Internship 0  Practicum 0  Other (please specify type and hours): 0

Schedule Type(s): L  Grading Mode(s): L

Variable Topics Courses (list restrictions, including the maximum number of hours that can be earned**):
NA

** NOTE: This information must be included in the course description.

Restrictions (Variable Topics Course): NA

Prerequisite(s): Minimum performance standard scores on reading, writing, and mathematics preassessment placement tests

Corequisite(s): None

Prerequisite(s) or Corequisite(s): None

Banner Enforced:
Prerequisite(s): None
Corequisite(s): None
Prerequisite(s) or Corequisite(s): None

Catalog Course Description:
This course introduces students to environmental concepts and issues from an interdisciplinary approach. Students will gain an understanding of the scientific methods and techniques needed to understand and analyze environmental issues such as ecology, human population growth, soils and agriculture, deforestation, urbanization, air pollution, freshwater resources, ocean pollution, climate change, fossil fuels, alternative energy sources, waste disposal as well as environmental ethics and policy. Course topics will be complemented with computer exercises.

APPROVED:

[Signature]

Department Chair OR Program Director: Date

Dean OR Associate Dean: Date

Associate VP, Academic Affairs: Date

*If crosslisted, attach completed Course Crosslisting Agreement Form
Prefix and Course Number: ENV 1200

Required Reading and Other Materials will be equivalent to:


(Relation to specific General Studies student learning outcomes are listed in parentheses)

Upon completion of this course, students will be able to:

1. Identify the major components of the physical environment (19);

2. Discuss the scientific method in relation to assessing the environment (10, 11, 19, 20, 21);

3. Explain the issues and approaches to decision-making on environmental and resource matters (2, 10);

4. Explain important environmental topics dealing with human population growth, soil resources, biodiversity, urban growth, freshwater, oceans, air quality, and climate change (2, 10, 11, 19);

5. Evaluate the benefits and impacts of energy sources including coal, oil, natural gas, nuclear power, geothermal power, wind energy, solar power, and other alternative sources (2, 10, 11, 19, 20);

6. Analyze numerical data presented in graphs and maps and interpret statistical data (1, 10, 11, 19, 20, 21);

7. Exhibit proficient use of technology through online learning modules (1, 19)

Detailed Outline of Course Content (Major Topics and Subtopics)

1. Foundations of Environmental Science
   a. Introduction to Environmental Science (2, 10, 11, 20, 21)
   b. Environmental Ethics and Policy (2, 10, 19)
   c. Chemistry to Energy to Life (10, 11, 20, 21)
   d. Evolution, Biodiversity, and Population Ecology (1, 2, 10, 11, 20, 21)
   e. Species Interactions and Community Ecology (1, 2, 10, 11, 20, 21)
   f. Environmental Systems and Ecosystem Ecology (1, 2, 10, 11, 20, 21)

2. Environmental Issues – the Search for Solutions
   a. Human Population (1, 2, 11, 19, 20, 21)
      i. Demography
      ii. Population and Society
   b. Soils and Agriculture (1, 10, 11, 19, 20, 21)
      i. Soil as a System
      ii. Soil Degradation
      iii. The Race to Feed the World
      iv. Genetic Modification of Food
      v. Aquaculture
      vi. Sustainable Agriculture
   c. Biodiversity and Conservation Biology (10, 19, 20)
i. Biodiversity Loss and Species Extinction
ii. Conservation Biology

d. Resource Management (10, 11, 19)
i. Forestry
ii. Land Use
iii. Protected Areas

e. Urbanization and Creating Livable Cities (1, 10, 11)
i. Sprawl
ii. Creating Livable Cities
iii. Urban Sustainability

f. Freshwater Resources (1, 2, 10, 11, 19, 20, 21)
i. How we use water
ii. Solutions to freshwater depletion
iii. Freshwater pollution
iv. Wastewater and its Treatment

g. The Oceans (10, 11)
i. Oceanography
ii. Marine Ecosystems
iii. Human Use and Impact
iv. Marine Conservation Biology

h. Atmospheric Science and Air Pollution (1, 2, 10, 11, 19, 20, 21)
i. Outdoor Air Pollution
ii. Indoor Air Pollution

i. Global Climate Change (1, 2, 10, 11, 19, 20, 21)
i. Methods of Studying Climate Change
ii. Climate Change Estimates
iii. Debates
iv. Reduced Emissions

j. Fossil Fuels (10, 11, 19, 20, 21)
i. Coal
ii. Oil
iii. Natural Gas
iv. Environmental Impacts

k. Conventional Energy Alternatives (10, 11, 19, 20, 21)
i. Nuclear Power
ii. Biomass Energy
iii. Hydroelectric Power

l. New Renewable Energy Alternatives (1, 2, 10, 11, 19, 20, 21)
i. Solar
ii. Wind
iii. Geothermal
iv. Oceans

m. Waste Management (1, 2, 10, 11, 19)
i. Solid Waste
ii. Industrial Waste
iii. Hazardous Waste

Evaluation of Student Performance (format: l, a, i, ii, etc.):
1. Examinations on the scientific material presented
2. Homework/In-class written assignments that focus on gathering, analyzing, interpreting, and displaying scientific data
3. Online learning modules (optional)
4. Evaluation may also include quizzes or class participation
REQUEST FOR GENERAL STUDIES DESIGNATION (2010-11)
NATURAL AND PHYSICAL SCIENCES

Please review the Course Selection Criteria for this category for assistance in completing this form, particularly as it relates to the percentages associated with each Student Learning Outcome.

If this course is also being submitted for the Global Diversity Category, check here □, and complete and attach the separate Global Diversity General Studies Designation request.

Date: 1/24/11

School: LAS

Department: EAS

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<td>1200</td>
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Title: Introduction to Environmental Science

Prerequisite(s): Minimum performance standard scores on reading, writing, and mathematics placement tests

Corequisite(s): None

Banner enforced prerequisite(s) and/or corequisite(s): None

Recommended maximum enrollment per section: 30
A. Student Learning Outcomes

Describe the specific ways in which this course addresses each of these Student Learning Outcomes, providing students opportunities to develop the skills and/or acquire the knowledge. Include reference to readings, discussions, lectures, and other pedagogical tools which will be used. See the Criteria Table for examples.

1. Demonstrate effective use of technologies appropriate to the task and discipline. (10%)

- Students are expected to:
  - Complete supplemental online environmental science exercises,
  - Manage assignments, announcements, or lecture notes via the WebCT Vista or Luminis Platform,
  - Utilize learning modules on the publisher’s website (practice quizzes, flashcards, case studies, virtual field trips, etc.),
  - Conduct internet searches for scientific publications and/or data,
  - Communicate with their instructor via the campus email system,
  - Use appropriate library research tools such as databases, and
  - Display scientific data using spreadsheets or graphing software.

2. Demonstrate the ability to locate sources when information is needed, and to evaluate the authenticity, validity, and reliability of resources applied to a specific purpose. (10%)

- Students will be required to gather information for written reports or exercises. In all cases, students must demonstrate an understanding of validity as expressed by the peer review process and distinguish between primary and secondary sources.

10. Describe how the methods of science are used to generate new knowledge. (30%)

- The historical context of environmental science will provide many examples of how the science has evolved. The following topics illustrate how science can be used to generate new knowledge:
  i. Steps in the scientific method
  ii. Speciation
     1. A discussion of how evolution and Darwin’s ideas have transpired.
     2. New species have been discovered through use of DNA analysis (not previously possible)
  iii. Pollution (air, water, soil, oceans)
     1. A discussion of laws and regulations and how pollution reduction has been improved through education and technology
     2. Hands-on activities where students gather data about water quality, air pollution, or soil conditions will improve students’ ability to hypothesize, distinguish between descriptive and experimental science, and categorize data.
  iv. Energy
     1. What we have depended on: Fossil Fuels
2. What may be a solution: Alternative energy sources (nuclear, geothermal, etc.)
3. Where we are going: Renewable energy sources (wind, solar, hydrogen)

11. Use graphical, symbolic and statistical methods to organize, analyze and interpret data in a manner appropriate to the discipline. (25%)

- Students are expected to participate in hands-on activities to gather data about water quality, air pollution, or soil conditions. Dependent and independent variables will be identified. Students must summarize results through graphs and calculate basic statistics on the dataset.
- Students must complete supplemental online learning modules which highlight how to display and interpret environmental data.

19. Describe the foundational knowledge and impacts of a field of science using analytical tools appropriate to the field. (60%)

- Students are expected to understand the foundations and issues of the following topics that pertain to environmental science:
  - Ecology
  - Human Population growth
  - Sustainable urban areas
  - Pollution (water, air, soil, oceans)
  - Climate Change
  - Energy (fossil fuels and renewable energy)
  - Waste Management

20. Use knowledge and observations to formulate hypotheses, identify relevant variables and design experiments to test hypotheses. (10%)

- Students will conduct exercises that illustrate the scientific method. Students gather data and hypothesize what might be causing outliers or attempt to explain why a particular pattern exists. For example, water samples may indicate that the pH of water entering Cherry Creek is more acidic than the main stream channel. What has caused the pH to be lower in the entering water? Is the soil the source? Is the fertilizer the source? Students must identify important variables and speculate as to what might be the cause.

21. Develop concepts of accuracy, precision, and the role of repeatability in the acquisition of scientific data. (10%)

- These concepts will be explicitly addressed in the beginning of the course within the context of the scientific method. The concepts will be reinforced during hands-on exercises. Students will be asked to repeat measurements or compare findings with other groups to determine instrument accuracy and precision.
B. Assessment of Student Learning

Identify and describe at least one specific form of assessing student achievement of each Student Learning Outcome which will be a regular part of the course. Include attachments as applicable. A single piece of student work may be used to assess student achievement of more than one Student Learning Outcome. See the Criteria Table for potential data for use in assessment.

1. Demonstrate effective use of technologies appropriate to the task and discipline.
   - Online supplemental exercises (Attachment 1 – students explore environmental topics via Adobe flash learning modules. Students submit their answers online.)
   - Written reports that require use of spreadsheets or graphing software (Attachment 2 – in this assignment, students gather data about water quality and graph their results.)
   - Homework/Problem Sets/Quiz/Examination/Writing Assignment submissions via the WebCT Vista platform or via email attachments

2. Demonstrate the ability to locate sources when information is needed, and to evaluate the authenticity, validity, and reliability of resources applied to a specific purpose.
   - In-class case studies – students read two short viewpoints and must decide who is correct. For example, there is a debate whether excess nitrogen or extra phosphorus causes more eutrophication (excess algae growth in water). Students read two opposing viewpoints, discuss in small groups, and must reach a consensus as to who is correct.
   - Writing assignments (Attachment 4 – Students watch An Inconvenient Truth and compare facts from the movie with those published on a website and another anti-global warming published article.)

10. Describe how the methods of science are used to generate new knowledge.
   - Written exercises are designed to evaluate whether students can describe and complete the important steps in the scientific method, make hypotheses, describe relevant methods, and discern between descriptive and experimental science (Attachment 2/3 – Water Quality/Air Pollution Exercise).
   - Discussions/lectures/course readings will reinforce the learning outcome.
   - Examinations

11. Use graphical, symbolic and statistical methods to organize, analyze and interpret data in a manner appropriate to the discipline.
   - Written assignments require displaying and analyzing environmental data (Attachment 2/3).
   - Discussions/lectures/course readings that display figures such as:
     - Reduction in sulfur dioxide emissions over time
     - Species extinction over time
     - Correlation between number of children born and education
     - Pollution produced by transportation to cities
o Pie charts of energy usage
- Examinations that require interpretation of figures/graphs (Attachment 5).

19. Describe the foundational knowledge and impacts of a field of science using analytical tools appropriate to the field.

- Examinations will assess the student’s understating and applications of environmental science themes (Attachment 5).
- Discussions/lectures/course readings will provide students with exposure to terminology, basic and applied science, and unintended consequences of scientific applications (such as how the green revolution improved agricultural production, but today we are discovering the consequences associated with using pesticides, herbicides, or other chemicals).
- Hands-on exercises/demonstrations will illustrate how to sample air quality, soil properties, etc. using analytical tools (Attachment 2/3).

20. Use knowledge and observations to formulate hypotheses, identify relevant variables and design experiments to test hypotheses.

- Writing assignments that mimic the scientific process (Attachment 2/3)
- Discussions/lectures/course readings that highlight important variables being analyze and potential causes.
- Examinations that require interpretation of data.


- Writing assignments that require students to obtain data and reflect on its accuracy (Attachment 2/3)
- Discussions/lectures/course readings that define error, precision, and accuracy.
- Examinations that require interpretation of uncertainty.

C. Conformance with Course Selection Guidelines

Briefly describe how the course meets the course section guidelines

☐ The course must meet the full requirements of the Student Learning Outcomes, or must be paired with a corequisite lab course that, as a pair complete the outcomes.

  o The course is a stand-alone course with no corequisite lab. As documented above, the course addresses each of the student learning outcomes.

☐ The course does not require a prerequisite within the discipline (or provide justification if it is an essential prerequisite).

  o The course has no prerequisites other than minimum placement scores.
Approvals:

Department Curriculum Committee / Date

Department Chair or Program Director / Date

School Curriculum Committee / Date

Dean or Associate Dean / Date

Chair, General Studies Committee / Date

Associate Vice President, Academic Affairs / Date
Omnicourse Syllabus

Metropolitan State College
School of Letters, Arts, and Sciences

Department of Earth and Atmospheric Sciences
Instructor: Frederick E. Welsh

Prefix & Course No. GEL 150
Semester Offered: Summer, 1997

Course Title: Geologic Investigations of the Green River

Semester Credit Hours: 3
Contact Hours: 15
Lab Hours*: 60

Prerequisites/Corequisites: None

Required Reading Materials (Title, Author, Publisher, Copyright Date)

Evaluation of Student Performance
Final exam and field-project report.

Specific (Measurable) Student Behavioral Learning Objectives

Upon completion of this course the student should be able to:

1. discuss the regional geology and geography of the Colorado Plateau;
2. on the basis of rock types and sedimentary structures observed along the Green River, interpret the stratigraphy and geologic history of the Colorado Plateau;
3. discuss the stratigraphy and geologic history of the Colorado Plateau to that of the Colorado Front Range;
4. describe the geomorphic features of the Colorado Plateau and discuss the geologic processes responsible for them;
5. discuss the mechanics of the fluvial system using the Green River as a case study; and
6. communicate this knowledge in the form of a geologic report.
DETAILED OUTLINE OF COURSE CONTENT (MAJOR HEADINGS/SUBTITLES) OR OUTLINE OF FIELD EXPERIENCE/INTERNSHIP (EXPERIENCE, RESPONSIBILITIES AND SUPERVISION)

Classroom lectures

A. General course objectives
B. Basic geologic principles and concepts
   a. Geologic time
   b. Rock cycle and rock types, with emphasis on sedimentary rocks
   c. Principles of uniformitarianism, original horizontality, and superposition
   d. Tectonics, including orogenesis and epeirogenesis
   e. Depositional environments (how rocks were formed)
   f. Sedimentary structures
   g. Formations and geologic maps
C. Regional geographic and geologic settings of Colorado Plateau
D. Stratigraphic column of Colorado Plateau
E. The Fluvial System
   a. Critical variables
      1. Velocity
      2. Discharge
      3. Turbulence
   b. River morphology
   c. Downcutting versus lateral cutting
   d. Meander mechanics
   e. Incised meanders
F. Logistics
   Field lectures in Colorado Plateau (observations and recordings)
   A. Plateau formations
      a. Geologic age
      b. Rock type(s)
      c. Depositional environments
   B. Salt tectonics
      a. Anticlines
      b. Faulting and jointing
   C. Plateau geomorphic features and relationship to weathering and erosional processes
      a. Plateaus, mesas, buttes, pinnacles, cliffs, and canyons
      b. Arches and fins
      c. Needles
      d. Entrenched meanders
   D. Igneous activity of Colorado Plateau
   E. Regional geologic history of Colorado Plateau
      a. Pre-Laramide events
      b. Laramide events
      c. Post-Laramide events

III. Course requirements
A. Field-trip exam
B. Field-project report
APPROVAL:
ALL OMNIBUS COURSES: 

HAIR, CURRICULUM COMMITTEE: 
DEPARTMENT CHAIR: 
DEAN, SCHOOL/CENTER: 
V.P. ACADEMIC AFFAIRS: 

LOCATION OF INTERNSHIP: 
FACULTY EVALUATION GROUP: 
FIELD SUPERVISOR* 

*APPROVAL BY THE FIELD SUPERVISOR IS REQUIRED, AND MUST BE INDICATED BY THE ORIGINAL SIGNATURE OF THAT SUPERVISOR OF THE SYLLABUS.

(GUIDELINES AS SET FORTH IN THE OMNIBUS COURSE SECTION OF THE CATALOG MUST BE FOLLOWED. AN ACCURATE COPY OF EACH COURSE MUST BE ON FILE IN THE OFFICE OF ACADEMIC AFFAIRS PRIOR TO THE LISTING OF SUCH COURSE IN ANY SEMESTER SCHEDULE.)

CUR #03: JULY 86
ACADEMIC AFFAIRS
METROPOLITAN STATE COLLEGE OF DENVER
Omnibus Course Syllabus

School of Letters, Arts and Sciences

Department: Earth and Atmospheric Sciences  Instructor: Randy Ogg

Prefix and Course Number: EG 150  Semester/year offered: Summer, 2001

Meeting Times/Dates: Monday and Wednesday, June 4 and 6 and Thursday, July 12 from 5:30 to 8:30 and All day Saturday, June 9 and Friday, Saturday, and Sunday, June 15, 16, and 17

Student will participate in class discussions, evaluate/analyze supplemental reading material, prepare a paper on wetland ecology, and take a final exam.

1. Participation in required field lectures
   a. Local field lecture, 10%
   b. Extended weekend field lecture, 40%

2. Final examination, 20%

3. 5- to 7-page paper, 30%
Specific (measurable) Student Behavioral Learning Objectives: Upon successful completion of this course, students should be able to:
1. explain varying wetlands definitions;
2. discuss the objectives of wetlands ecology;
3. discuss the local and regional distribution of wetlands;
4. provide an overview of wetlands science, including the geology, hydrogeology, biogeochemistry, biological adaptations, ecosystems development;
5. discuss key federal/state wetlands/water laws and regulations, as well as emerging federal/state policies;
6. discuss wetlands protection and restoration; and
7. discuss wetlands management practices.

Detailed outline of course content (major topics and subtopics) or outline of field experience/internship (experience, responsibilities and supervision):

A. Wetlands history
B. Wetland laws/regulations (USEPA/USACE)
C. Ground water and surface water hydrology
D. Wetlands soil structures/types
E. Wetland definitions
F. Wetland protection
G. Spatial distribution of wetlands
H. Wetland banking
I. Types of wetlands
J. Sources of wetland pollution
K. Variations in wetlands
L. Management of wetlands
M. Development of wetlands
N. Wetland Restoration

Approved - Omnibus course:

[Signature]
Department Chair
[Date]

[Signature]
Dean of School
[Date]

[Signature]
Associate Vice President for Academic Affairs
[Date]
COURSE CROSSLISTING AGREEMENT FORM
The Metropolitan State College of Denver

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Beginning **2001/00** (semester and year).

Approved:

- Department Chair/Institute Director

Please forward the completed form to the Office of Academic Affairs for processing and recordkeeping (CN 318, Box 48). It will remain in force until rescinded by one of the parties using the Crosslisting Termination Form.
METROPOLITAN STATE COLLEGE OF DENVER
Omnibus Course Syllabus

School of Letters, Arts and Sciences

Department: Earth and Atmospheric Sciences  Instructor: Ogg
Prefix and Course Number: GEG 150  Semester/year offered: Fall, 2001
Banner Number (for Academic Affairs use): 607

Course Title: Ecology of the Continental Divide

Credit Hours: 2+0  Contact Hours-students: 30  Total Other Hours*:  
Contact Hours-faculty: 30

Meeting Times/Dates: Three lectures (Wednesdays, October 3, 10, and 31, from 5:30 to 7:30) and one field lecture (4 days/3 nights: Thursday through Sunday, October 11 through 14)

Grading Mode(s): L  Schedule Type(s): L

Prerequisites/Corequisites: GEG 1200 or permission of instructor

Required Reading Materials (author, title, publisher, copyright date):

Text to be determined

Evaluation of Student Performance:

Students will be required to prepare a summary term paper that reflects their learning objectives from the four days spent studying and evaluating the Continental Divide ecological characteristics. The paper will be 8-10 pages in length

Specific (measurable) Student Behavioral Learning Objectives:

1. Each student will be evaluated on their ability to identify flora and fauna characteristics associated with the Continental Divide region and their ecological transition zones. Students will evaluate wildlife migratory routes, and how the Continental Divide impacts/supports those routes.
2. Students will learn to identify montane wetlands and their characteristics (e.g., hydrology, soil, vegetation, geomorphology), benefits of wetlands, and environmental impacts.
3. Students will be required to evaluate the hydrologic regime of the Continental Divide that includes watershed hydrology, alpine rivers and lakes systems, water quality impacts from non-point sources of pollution (e.g., acid rain deposition, trail usage, animals).

4. Students will be assigned group/individual exercises each day that includes unique learning objectives for evaluating vegetation/mammals/hydrology/environmental impacts/ecological transitions/wetlands. This data collection process will be utilized in preparation of the student’s final term paper.

Detailed outline of course content (major topics and subtopics) or outline of field experience/internship (experience, responsibilities and supervision):

I. Mountain Ecology/Habitats
   A. Types and characteristics of Tundra
   B. Mountain Ecology Zones/Transitions
   C. Flora/Fauna Identification & Habitats
   D. Terrestrial/Mammal Migratory Routes
   E. Aquatic Habitats

II. Rocky Mountain Wetlands
   A. Montane Wetlands of the Rocky Mountains
   B. Wetland Soil Types
   C. Wetland Vegetation
   D. Wetland Benefits
   E. Geomorphology and Hydrology of Wetlands
   F. Environmental Impacts of Wetlands

III. Rocky Mountain Geology/Hydrology
   A. General Geology of the Rocky Mountains
   B. Origins of the Rocky Mountains
   C. Watershed Hydrology
   D. Alpine Rivers/Lakes Hydrology
   E. Water Quality
   F. Rocky Mountain Climates

IV. Rocky Mountain Management/Administration Agencies & Functions
   A. United States Forest Service
   B. United States National Park Service
   C. United States Bureau of Reclamation
   D. United States Bureau of Land Management
   E. United States Environmental Protection Agency
   F. United States Army Corps of Engineers

V. Continental Divide Trail
   A. History of the Continental Divide Trail
   B. Continental Divide Trail Alliance
   C. Continental Divide Trail Route
   D. Environmental Impacts of the Continental Divide Trail
   E. Protection of the Continental Divide Trail
**Approved - Omnibus course:**

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<td>James M. Conolly</td>
<td>12/21/00</td>
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<thead>
<tr>
<th>Dean of School</th>
<th>Date</th>
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<tr>
<td>Deanne Miller-Hart</td>
<td>12/21-08</td>
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<tr>
<th>Associate Vice President for Academic Affairs</th>
<th>Date</th>
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**Approved - Field Experience/Internship Only:**

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<th>Location of Internship</th>
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<th>Faculty Evaluation Group</th>
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<th>Field Supervisor**</th>
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**Approval by the Field Supervisor is required and must be indicated by the original signature of that supervisor on the syllabus.

Guidelines as set forth in the omnibus course section of the Bulletin must be followed. An accurate copy of each course syllabus must be on file in the Office of Academic Affairs prior to the listing of such course in any semester schedule.
School of: Letters, Arts and Sciences

Department: Earth and Atmospheric Sciences

CIP Code: 40.0601

Prefix & Course Number: ENV 1540 Crosslisted With*: N/A

Course Title: Geologic and Environmental Hazards - Denver and Vicinity

Check All That Apply: Required for Major: Required for Minor: Specified Elective: 
Required for Concentration: Elective: X Service Course: 

Credit Hours: 2 (2 +0)

Total Contact Hours per semester (assuming 15-16 week semester):
Lecture 30 Lab 0 Internship 0 Practicum 0 Other (please specify type and hours): 0

Schedule Type(s): Lecture 30 Grading Mode(s): L

Variable Topics Courses (list restrictions, including the maximum number of hours that can be earned*): N/A

*NOTE: This information must be included in the course description.

Restrictions (Variable Topics Course): N/A

Prerequisite(s): None; GEL 1010 recommended

Corequisite(s): None

Prerequisite(s) or Corequisite(s): None

Banner Enforced:
Prerequisite(s): None Corequisite(s): None Prerequisite(s) or Corequisite(s): None

Catalog Course Description: This course examines the geologic and environmental hazards around the Denver region, including mass wasting, swelling clays, subsidence, and flooding, as well as contamination and remediation efforts at the Lowry Landfill and the Rocky Mountain Arsenal. Future homeowners learn the meaning of "buyer beware." Note: Students cannot take both ENV 1540 and ENV 3540 for credit.

APPROVED:

Department Chair OR Program Director

Dean OR Associate Dean

Associate VP, Academic Affairs
Prefix and Course Number: ENV 1540

Required Reading and Other Materials will be equivalent to:


Specific, Measurable Student Behavioral Learning Objectives:

Upon completion of this course the student should be able to:
1. recognize the geologic and environmental hazards found in proximity to Denver;
2. explain the causes and processes responsible for the geologic and environmental hazards found in proximity to Denver;
3. discuss the remediation of the various hazards found in proximity to Denver; and
4. communicate this knowledge in the form of a summary field-trip report.

Detailed Outline of Course Content (Major Topics and Subtopics or Outline of Field Experience/Internship (experience, responsibilities and supervision)):

I. Classroom lectures
   A. General course objectives
   B. Basic geologic principles and concepts
      1. Rock cycle and rock types
      2. Principles of uniformitarianism, original horizontality, and superposition
   C. Types of hazards
      1. Mass wasting, including influencing factors and classification
      2. Subsidence
      3. Swelling clays, including the geology and chemistry of swelling clays as well as remedial construction practices
      4. Flooding
   D. Sanitary landfills
      1. Geologic concerns
      2. Environmental problems
   E. Logistics

II. Field lectures (observations and recordings)
   A. Denver-Arapahoe Disposal Site (Lowry Landfill)
      1. Construction practices
      2. Leachate containment
      3. Hazardous waste remediation
   B. Rocky Mountain Arsenal
      1. Environmental clean-up
      2. Wildlife habitat
   C. Mass wasting
      1. Soil creep
      2. Flows
      3. Slips, including slumps and slides
      4. Falls
      5. Mass wasting remediation
   D. Subsidence
      1. Coal mines
      2. Improper compaction
   E. Swelling clays
      1. Impacts on structures
      2. Remediation of swelling clays utilizing improved construction and landscaping practices
   F. Flooding
      1. Flood frequency
      2. Land use planning
III. Course requirements
   A. Field-trip exam
   B. Summary field-trip report

Evaluation of Student Performance:

1. Class attendance and participation.
2. Final exam and summary field-trip report.
REGULAR COURSE SYLLABUS

School of: Letters, Arts, and Sciences

Department: Earth and Atmospheric Sciences

Prefix & Course Number: ENV 2000  Crosslisted With*: 

Course Title: Applied Pollution Science

Check All That Apply: 
Required for Major: 
Required for Minor: 
Specified Elective: X

Required for Concentration: 
Elective: X 
Service Course: 

Credit Hours: 3 (2+2)

Total Contact Hours per semester (assuming 15-16 week semester):

Lecture 30  Lab 30  Internship  Practicum 

Schedule Type(s): L  Grading Mode(s): L

Variable Topics Courses (list restrictions, including the maximum number of hours that can be earned**):

**NOTE: This information must be included in the course description.

Restrictions (Variable Topics Course): 

Prerequisite(s): ENV 1200; CHE 1800; CHE 1810

Corequisite(s): None

Prerequisite(s) or Corequisite(s): None

Banner Enforced:

Prerequisite(s): ENV 1200; CHE 1800; CHE 1810
Corequisite(s): None
Prerequisite(s) or Corequisite(s): None

Catalog Course Description:

This course introduces students to the abiotic and biotic scientific processes within the soil/water/atmosphere continuum that affects the fate and transport of pollutants. The extent, fate, mitigation, and impact of environmental pollution will be examined through applied examples and case studies.

APPROVED:

Digitally signed by Jason Janke
DN: cn=Jason Janke, o, ou, email=jjanke1@mscd.edu, c=US
Date: 2012.11.07 13:20:57 -07'00'

*If crosslisted, attach completed Course Crosslisting Agreement Form
Required Reading and Other Materials will be equivalent to:

Specific, Measurable Student Behavioral Learning Objectives:
Upon completion of this course the student will be able to

1. Identify and explain the physical and chemical parameters in soils controlling the movement of water and solutes.
2. Explain the role of microorganisms and biological processes in soil-water systems in regulating contaminant/nutrient concentrations.
3. Explain the chemical and physical processes affecting contaminant transport and fate in environmental systems.
4. Evaluate the impact of various land-use activities on surface and groundwater quality.
5. Assess the effectiveness of various approaches to solid waste disposal on environmental quality.
6. Predict the behavior of herbicide and organic contaminants in sediment and pore water.
7. Critically examine the validity of environmental soil-water data, and sampling/analytical methods used to obtain this data.

Detailed Outline of Course Content (Major Topics and Subtopics) or Outline of Field Experience/Internship (experience, responsibilities and supervision)

   a. Soil and Subsurface environment
   b. Solid Phase
   c. Gaseous Phase
   d. Liquid Phase
   e. Basic physical Properties
   f. Laboratory Activity: Measurement and Statistics
2. Physical-Chemical Characteristics of Water
   a. Mechanical Properties.
   b. Chemical properties
   c. Lakes and Reservoirs
   d. Streams and Rivers
   e. Groundwater
   f. Laboratory Activity: Determination of water alkalinity and pH
3. Biotic Characteristics of the Environment
   a. Major groups of organisms
   b. Microorganisms in subsurface soils.
   c. Soil as an Environment for microbes
   d. Microorganisms in Surface Waters
   e. Microorganisms in Air
   f. Laboratory Activity: Determination of water hardness
4. Physical Processes Affecting Contaminant Transport and Fate
   a. Contaminant properties.
   b. Characterizing Spatial and Temporal Distributions of Contaminants.
   c. Laboratory Activity: Soil sampling-pH contours
5. Chemical Processes Affecting Contaminant Transport and Fate
a. Basic Properties of Inorganic Contaminants.
c. Sorption Processes
d. Abiotic Transformation Reactions
e. Laboratory Activity: Pollutant Transport (Part 1)

6. Soil and Land Pollution
a. Surface Mining
b. Deforestation-Soil Erosion
c. Soil Acidity-Salinity
d. Agricultural Activities Fertilization-Animal Wastes
e. Industrial Wastes With High Salt and Organic Chemicals
f. Laboratory Activity: Pollutant transport (Part II)

7. Subsurface Pollution
a. Groundwater Pollution
b. Groundwater Risk Assessment
c. Point-Source Contamination.
d. Diffuse-Source Contamination.
e. Laboratory Activity: Aeration/De-aeration water.

8. Surface Water Pollution
a. Sources of Surface Water Pollution.
b. Sediments as Surface Water contaminants
c. Nutrients and Eutrophication.
e. Surface Water Pollution Modeling
f. Laboratory Activity: BOD5 Determination (Part I)

9. Soil and Groundwater Remediation
a. Superfund Process
b. Site Characterization.
c. Remedial Strategies and Technologies
d. In Situ Treatment.
e. Laboratory Activity: BOD5 Determination (Part II)

10. Atmospheric Pollution
a. Sources, Types, and Effects of Air Pollution.
b. Secondary Pollutants
c. Pollutants and Radiative Effects.
d. Weather and Pollutants
e. Laboratory Activity: Acid rock drainage-experimental setups

11. Industrial and Municipal Solid Waste Treatment and Disposal
a. Relevant Regulations for Industrial and Municipal Solid Wastes.
b. Major Forms of Industrial Waste.
c. Treatment and Disposal of Industrial Wastes.
d. Treatment and Disposal of Municipal solid Waste.
e. Laboratory Activity: Field sampling techniques-water

12. Municipal Wastewater Treatment
a. Nature of Sewage  
b. Modern Wastewater Treatments  
c. Wetlands and Aquaculture systems  
d. Sludge Processing.  
e. Laboratory Activity: Analysis of field water samples

a. Wastewater (Sewage) Treatment  
b. Methods and Benefits of Land Application of Bio-solids  
c. Hazards of Land Application of Bio-solids  
d. Nonpoint Versus Point Source Pollution  
e. Laboratory Activity: Analysis of acid rock drainage rock and water samples

14. Drinking Water Treatment and Security  
a. Water Treatment Processes  
b. Disinfection and Disinfection By-Products  
c. Residential Water Treatment.  
d. Laboratory Activity: Geochemical computer modeling

15. Ecosystem Restoration and Land Reclamation.  
a. Site Characterization.  
b. Site Restoration and Monitoring.  
c. Approaches to Ecosystem Restoration.  
d. Land Reclamation, Saline-Sodic Soils.  
e. Laboratory Activity: Presentation reports on acid rock drainage

Evaluation of Student Performance

1. Examinations  
2. Term paper, or equivalent to critical review paper  
3. Laboratory Reports  
4. Problem sets  
5. Case studies
REGULAR COURSE SYLLABUS

School of: Letters, Arts, and Sciences

Department: Earth and Atmospheric Sciences

Prefix & Course Number: ENV 2100

Course Title: Basic Water Sampling and Analysis

Check All That Apply:
- Required for Major: X
- Required for Minor: ___
- Specified Elective: X
- Required for Concentration: X
- Elective: X
- Service Course: ___

Credit Hours: 2 (2+2)

Total Contact Hours per semester (assuming 15-16 week semester):
- Lecture 30
- Lab 30
- Internship ___
- Practicum ___
- Other (please specify type and hours): ___

Schedule Type(s): L
Grading Mode(s): L

Variable Topics Courses (list restrictions, including the maximum number of hours that can be earned**):

** NOTE: This information must be included in the course description.

Restrictions (Variable Topics Course): ___

Prerequisite(s): Completion of General Studies Requirements: WC, OC, OL, and N&P Sciences

Corequisite(s): None

Prerequisite(s) or Corequisite(s): None

Banner Enforced:
- Prerequisite(s): Completion of General Studies Requirements: WC, OC, OL, and N&P Sciences
- Corequisite(s): None
- Prerequisite(s) or Corequisite(s): None

Catalog Course Description:
Water quality information, including the consequences of pollution and other disturbances, is commonly used to indicate the health of an ecosystem. This course exposes students to the methods and techniques used in water quality sampling. Students will learn how to collect water samples in the field, analyze their results, and summarize the implications of the results. Students will also have the opportunity to learn how to collect and identify aquatic insects as an indicator of environmental health. Field sampling of the Cherry Creek and a one-day field trip on a weekend are mandatory.

APPROVED:

Digitally signed by Jason Janke
DN: cn=Jason Janke, o, ou, email=jjanke1@mscd.edu, c=US
Date: 2013.11.07 13:21:28 -07'00'

*If crosslisted, attach completed Course Crosslisting Agreement Form
Required Reading and Other Materials will be equivalent to:


Specific, Measurable Student Behavioral Learning Objectives:
1. Explain the water chemistry of rivers and lakes
2. Design a water quality monitoring program
3. Operate instruments to collect data on water chemistry
4. Analyze field data and compare data to state water quality standards
5. Identify common aquatic insect species used as water quality indicators
6. Design an effective oral presentation of individual research

Detailed Outline of Course Content (Major Topics and Subtopics) or Outline of Field Experience/Internship (experience, responsibilities and supervision)
1. Water Quality Analysis
   A. Introduction to Water
      i. Chemical characteristics of water
      ii. Physical characteristics of water
      iii. Aquatic ecosystems
         1. Streams
         2. Lakes
         3. Wetlands
         4. Groundwater
   B. Anthropogenic Impacts
      i. Pollutant sources & pathways
      ii. Spatial & temporal variations
   C. Strategies for Water Quality Assessment
      i. Purpose of monitoring
         1. Clean Water Act compliance
         2. Citizen monitoring
         3. Colorado Department of Public Health and Environment
      ii. Design of monitoring program
      iii. Data processing
      iv. Data quality control
      v. Interpretation
      vi. Dissemination
D. Water Quality Parameters: What they mean and how to measure them
   i. Temperature
   ii. pH
   iii. Turbidity
   iv. Conductivity & salinity
   v. Dissolved Oxygen
   vi. Alkalinity & Hardness
   vii. Chlorophyll a & b
   viii. Dissolved metals
   ix. Nutrients
   x. Bacteria

2. Aquatic Macroinvertebrates (insects)
   A. Life cycles
   B. Common species identification methods
   C. Collecting macroinvertebrate samples
   D. Analyzing & summarizing data

3. Field Trip
   A. Practice water sampling in the field
   B. Collect water chemistry data
   C. Collect macroinvertebrate samples
   D. Analyze water chemistry & macroinvertebrate data
   E. Summarize significant results

4. Individual Water Quality Research
   A. Identify a topic
   B. Design a water quality sampling experiment
   C. Collect data on water chemistry & macroinvertebrates
   D. Analyze results
   E. Present data and results during a formal in-class presentation

5. Water Treatment Systems
   A. Water collection (sewer)
   B. Water delivery (tap)

6. Water Pollution Control Methods
   A. Section 303(d) list of impaired waters
   B. TMDL(s)
   C. Watershed management plans

Evaluation of Student Performance
1. At least two Exams
2. Lab Exercises
3. Individual Research Project
   a) Research Proposal
   b) Data Collection
   c) Summary of Results
   d) Presentation
REGULAR COURSE SYLLABUS

School of: Letters, Arts and Sciences
Department: Earth and Atmospheric Sciences
Prefix & Course Number: ENV 3400 Crosslisted With*: N/A
Course Title: Water Resources
Banner course title (30 characters): Water Resources
Check All That Apply: Required for Major: x Required for Minor: ___ Specified Elective: x
Required for Concentration: x Elective: x Service Course: ___

To receive Title IV financial aid funds, all institutions of higher education must comply with the federal definition of a credit hour. The Higher Learning Commission requires institutions to maintain policies and procedures for verifying compliance with this definition.

Federal Credit Hour Definition: A credit hour is an amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally-established equivalency that reasonably approximates not less than:
(1) one hour of classroom or direct faculty instruction and a minimum of two hours of out-of-class student work each week for approximately fifteen weeks for one semester or trimester hour of credit, or ten to twelve weeks for one quarter hour of credit, or the equivalent amount of work over a different amount of time; or (2) at least an equivalent amount of work as required in paragraph (1) of this definition for other activities as established by an institution, including laboratory work, internships, practica, studio work, and other academic work leading toward to the award of credit hours. 34 CFR 600.2 (1/1/2010)

Credit Hours: 3 (3+0)

Face-to-Face or Equivalent Hours per course:
Lecture 45 Lab 0 Internship 0 Practicum 0 Other (please specify type and hours): L
Additional Student Work Hours per course: ___
Schedule Type: ___ Grade Mode: ___
Variable topics umbrella course: No X Yes If Yes, number of credit hours allowed ___

Specified repeatable course: No ___ Yes ___

APPROVED:

[Signature] 9/26/13

Department Chair OR Program Director

[Signature] 9/15/13

Dean OR Associate Dean

[Signature] 12/06/13

Associate VP, Academic and Student Affairs

*If crosslisted, attach completed Course Crosslisting Agreement Form
Prefix and Course Number: ENV 3400

Prerequisite(s): (ENV 1200 or GEG 1920) and Completion of General Studies

Corequisite(s): ___

Prerequisite(s) or Corequisite(s): ___

Banner Enforced:
Prerequisite(s): (ENV 1200 or GEG 1920) and Completion of General Studies
Corequisite(s): ___
Prerequisite(s) or Corequisite(s): ___

Registration restrictions: Level _____ Class _____ Program/Major _____. Student attribute ____

Catalog Course Description:

This course presents an analysis of water as a major resource. It includes the study of the hydrologic cycle; competing water uses, current water problems, and approaches to water management. The relationship of water to land use is examined in terms of dams, watersheds, water laws, pollution, and flood control.

Specific Variable Topics Course Description (if applicable, umbrella course description included above):

Required Reading and Other Materials will be equivalent to:


Specific, Measurable Student Behavioral Learning Objectives:

Upon completion of this course the student should be able to
1. analyze the intricate interrelationships of the hydrologic cycle, including types of water storage and transfer;
2. compare and contrast sources of water and competing users;
3. analyze areas of water surplus and deficit in relation to land use;
4. compare the anthropocentric and ecocentric uses of water by region and land use;
5. assess current water problems;
6. relate water problems to specific regions and land uses;
7. solve water budget formulas for specific sites;
8. analyze sources and impacts of water pollution;
9. apply the principles and goals of water management; and
10. debate the application of major concepts in water law.

Detailed Outline of Course Content (Major Topics and Subtopics) or Outline of Field Experience/Internship (experience, responsibilities and supervision)

1. Importance of Water
   A. Water and nature
   B. Water and humanity
2. The hydrologic Cycle
   A. Conceptual ilode1
   B. Water budgets
3. Types of Water Resources
   A. Surface water
   B. Ice and snow
   C. Atmospheric water
   D. Groundwater
   E. Soil water
4. Water Uses
   A. Consumptive versus nonconsumptive uses
   B. Domestic
   C. Urban
   D. Industrial
   E. Mining
   F. Power generation
   G. Transportation
   H. Agriculture (irrigation)
   I. Recreation
   J. Habitat
   K. Waste disposal
5. Water Distribution on the Earth's Surface
   A. Areas of surplus
   B. Areas of deficit
6. Water Law
   A. Types of legal system (riparian versus appropriation)
   B. Development of laws: Past, present, and future
7. Principles of Water Management
   A. Watersheds and regional planning
   B. Multiple-use concepts
   C. Conservation and recycling
   D. Environmental impact
8. Water Pollution
   A. Types: Chemical and sediment
   B. Sources
   C. Legislation and enforcement
9. Current Issues in Water Resources

Evaluation of Student Performance
   Exams
   Projects
   Papers
   Presentations
   Exercises
REGULAR COURSE SYLLABUS

School of:  Letters, Arts and Sciences

Department:  Earth and Atmospheric Sciences

CIP Code:  40.0601

Prefix & Course Number:  ENV 3540  Crosslisted With*:  N/A

Course Title:  Advanced Geologic and Environmental Hazards - Denver and Vicinity

Check All That Apply:  Required for Major:  X  Required for Minor:  ____  Specified Elective:  X

Required for Concentration:  X  Elective:  X  Service Course:  ____

Credit Hours:  2 (2 + 0)

Total Contact Hours per semester (assuming 15-16 week semester):

  Lecture  30  Lab  0  Internship  0  Practicum  0  Other (please specify type and hours):  0

Schedule Type(s):  L  Grading Mode(s):  L

Variable Topics Courses (list restrictions, including the maximum number of hours that can be earned*):  N/A

*NOTE: This information must be included in the course description.

Restrictions (Variable Topics Course):  N/A

Prerequisite(s):  Nine hours of geography or geology, or permission of instructor

Corequisite(s):  None

Prerequisite(s) or Corequisite(s):  None

Banner Enforced:
  Prerequisite(s):  None
  Corequisite(s):  None
  Prerequisite(s) or Corequisite(s):  None

Catalog Course Description:  This course requires an analytical approach to the geologic and environmental hazards around the Denver region, including mass wasting, swelling clays, subsidence and flooding, as well as contamination and remediation efforts at the Lowry Landfill and the Rocky Mountain Arsenal. Future homeowners learn the meaning of "buyer beware." Note: Students cannot take both ENV 1540 and ENV 3540 for credit.

APPROVED:

[Signatures]

Department Chair OR Program Director  Date

Dean OR Associate Dean  Date

Associate VP, Academic Affairs  Date
Prefix and Course Number: ENV 3540

Required Reading and Other Materials will be equivalent to:

Specific, Measurable Student Behavioral Learning Objectives:

Upon completion of this course the student should be able to:
1. recognize and analyze the geologic and environmental hazards found in proximity to Denver;
2. analyze and debate the causes and processes responsible for the geologic and environmental hazards found in proximity to Denver;
3. propose, design, and/or choose procedures for remediating the hazards found in proximity to Denver; and
4. communicate this knowledge in the form of a geologic report.

Detailed Outline of Course Content (Major Topics and Subtopics or Outline of Field Experience/Internship (experience, responsibilities and supervision)):

I. Classroom lectures
   A. General course objectives
   B. Basic geologic principles and concepts
      1. Rock cycle and rock types
      2. Principles of uniformitarianism, original horizontality, and superposition
   C. Types of hazards
      1. Mass wasting, including influencing factors and classification
      2. Subsidence
      3. Swelling clays, including the geology and chemistry of swelling clays as well as remedial construction practices
      4. Flooding
   D. Sanitary landfills
      1. Geologic concerns
      2. Environmental problems
   E. Logistics

II. Field lectures (observations and recordings)
   A. Denver-Arapahoe Disposal Site (Lowry Landfill)
      1. Construction practices
      2. Leachate containment
      3. Hazardous waste remediation
   B. Rocky Mountain Arsenal
      1. Environmental clean-up
      2. Wildlife habitat
   C. Mass wasting
      1. Soil creep
      2. Flows
      3. Slips, including slumps and slides
      4. Falls
      5. Mass wasting remediation
   D. Subsidence
      1. Coal mines
      2. Improper compaction
   E. Swelling clays
      1. Impacts on structures
      2. Remediation of swelling clays utilizing improved construction and landscaping practices
   F. Flooding
      1. Flood frequency
2. Land use planning

III. Course requirements
   A. Field-trip exam
   B. Geologic report, including a comprehensive bibliography

Evaluation of Student Performance:

1. Class attendance and participation.
2. Final exam and geologic report.
REGULAR COURSE SYLLABUS

School of: Letters, Arts and Sciences

Department: Earth and Atmospheric Sciences

CIP Code: 40.0301

Prefix & Course Number: ENV 3620 Crosslisted With*: N/A

Course Title: Population, Resources, and Land Use.

Check All That Apply: Required for Major: ___ Required for Minor: ___ Specified Elective: X

Required for Concentration: X Elective: X Service Course: _____

Credit Hours: 3 (3 + 0)

Total Contact Hours per semester (assuming 15-16 week semester):

Lecture 45 Lab 0 Internship 0 Practicum 0 Other (please specify type and hours): 0

Schedule Type(s): L Grading Mode(s): L

Variable Topics Courses (list restrictions, including the maximum number of hours that can be earned*): N/A

*NOTE: This information must be included in the course description.

Restrictions (Variable Topics Course): N/A

Prerequisite(s): GEG 1000 or GEG 1300, 6 hours in geography; ENV 1400 recommended.

Corequisite(s): None

Prerequisite(s) or Corequisite(s): None

Banner Enforced:

Prerequisite(s): None
Corequisite(s): None
Prerequisite(s) or Corequisite(s): None

Catalog Course Description: This course examines the distribution and density of the global population and the relationship of these patterns to world resources and development problems. Population shifts, including birth, death, migration, and doubling rates are analyzed. Data analysis and projections are covered.

APPROVED:

[Signatures and dates for approval]

Department Chair OR Program Director

Dean OR Associate Dean

Associate VP, Academic Affairs
Prefix and Course Number:  ENV 3620

Required Reading and Other Materials will be equivalent to:


Specific, Measurable Student Behavioral Learning Objectives:

Upon completion of this course the student should be able to:
1. analyze the interdisciplinary nature of demographic studies;
2. examine population issues using geographic terms;
3. identify sources of population data and extrapolate information for use in class;
4. examine the function of the U.S. Bureau of the Census;
5. analyze census tract maps using raw data and critique the final products in writing;
6. analyze the factors that affect the global growth rates and how this affects distribution patterns;
7. evaluate theories of population growth;
8. analyze migration patterns using maps or raw data;
9. evaluate the theory of demographic transition and construct a basic chart from memory;
10. prepare a set of population pyramids from raw data and explain how they relate to demographic transition;
11. analyze world patterns of urbanization and explain why most of the major cities, by the year 2000, will be in developing countries;
12. develop population projections using current and historic data;
13. analyze relationships between population growth and level of economic development;
14. evaluate policy issues related to population;
15. analyze relationships between population growth and level of economic development;
16. debate ethical considerations related to population growth and control; and
17. analyze the role of demographics in land use planning, locational analysis, and social planning.

Detailed Outline of Course Content (Major Topics and Subtopics or Outline of Field Experience/Internship (experience, responsibilities and supervision)):

I. Introduction
   A. Overview - The interdisciplinary nature of demographics
   B. Review of basic geographic concepts

II. Sources of Demographic Data
   A. U.S. census
   B. Vital statistics

III. Overview of the World's Population
   A. Growth rates
   B. Regional population patterns
   C. Urbanization processes
   D. Mortality, fertility, and migration patterns

IV. Theories of Population Growth
   A. Malthus, Marx, and Durkheim
   B. Theory of demographic transition
   C. Theory of relative income

V. Census Tract Mapping

VI. Fertility Concepts and Measurement

VII. Fertility Trends
   A. Levels and explanations
   B. Regions and distributions
   C. Explanation of low fertility

VIII. Mortality Trends

IX. Migration
   A. Causes and consequences
   B. Migration patterns
   C. Immigration/emigration
   D. Interregional/intraregional

X. Age and Sex Structure
A. Impacts of migration, mortality, and fertility
B. Population dynamics
C. Population pyramids
D. Population pyramids and the demographic cycle

XI. Population Characteristics and Life Changes
XII. Population Growth: Women and the Family
XIII. Population Growth and Aging
XIV. Population Growth and Urbanization
   A. World patterns of urbanization
   B. Historic cities
   C. Urbanization by region

XV. Population Growth and Economic Development
XVI. Population Growth and Food
   A. Agricultural and industrial revolutions
   B. Green revolution
   C. Agricultural regions
   D. Developed versus developing countries
   E. Population distribution versus agricultural distribution
   F. Ethics

XVII. Population Policy
   A. Ethics, ethics, ethics
   B. Decision-making processes
   C. Impacts of decision making
   D. Family planning and social change

XVIII. Demographics
   A. Locational analysis
   B. Social planning
   C. Population projections

XIX. The Census and Political Boundary Issues

Evaluation of Student Performance:

I. Minimum of two major exams and any other exercises, projects, papers, or publications as required by the instructor.
School of: Letters, Arts, and Sciences
Department: Earth and Atmospheric Sciences
CIP Code: 03.0104
Prefix & Course Number: ENV 3700
Course Title: Mountain Environments
Check All That Apply: Required for Major: ___ Required for Minor: ___ Specified Elective: X
Required for Concentration: ___ Elective: X Service Course: ___
Credit Hours: 3 (3 + 0)

Total Contact Hours per semester (assuming 15-16 week semester):
Lecture 45 Lab ___ Internship ___ Practicum ___ Other (please specify type and hours): ___

Schedule Type(s): L Grading Mode(s): L
Variable Topics Courses (list restrictions, including the maximum number of hours that can be earned**): N/A

** NOTE: This information must be included in the course description.

Restrictions (Variable Topics Course): N/A

Prerequisite(s): ENV 1200, 9 hours in any combination of Environmental Science, Geology, Physical Geography, Biology, Chemistry, and Meteorology courses, and at least junior standing; or permission of instructor

Corequisite(s): None
Prerequisite(s) or Corequisite(s): None

Banner Enforced:
Prerequisite(s): ENV 1200
Corequisite(s): None
Prerequisite(s) or Corequisite(s): None

Catalog Course Description:
The course examines integrated mountain ecosystems, particularly in the Front Range of Colorado. Topics examined include vegetation distribution, climates, landforms and processes, wildlife, and human impacts. A weekend field trip to Rocky Mountain National Park is required.

APPROVED:

Department Chair OR Program Director

Dean OR Associate Dean

Associate VP, Academic Affairs
ENV 3700: Mountain Environments

Required Reading and Other Materials will be equivalent to:

Readings will be selected from the following:


As well as from various journal articles.

Specific, *Measurable* Student Behavioral Learning Objectives:

Upon completion of this course, students will be able to:
1. Compare and contrast the various physical processes (geologic, climatologic, biologic, and human) that shape mountain ranges of the world.
2. Identify and examine important issues that affect mountain environments currently and in the future.
3. Construct a research proposal that focuses on a mountain environmental problem.
4. Organize a professional oral presentation based on their research proposal.

Detailed Outline of Course Content:

1. Mountain Characteristics
   A. Introduction
      1. Mountain regions of the world
      2. Origins of mountains
      3. The nature and distinctiveness of mountains
      4. Environmental stresses
   B. Mountain Climates
      1. Latitudinal and Altitudinal controls
      2. Continentality and barriers
      3. Solar radiation
      4. Temperature and Humidity
      5. Local Winds
   C. Mountain Geomorphology
      1. Weathering
      2. Mass Movement
      3. Glaciation
      4. Slope form
      5. Periglacial activity
      6. Hydrology: Rivers and Streams
      7. Soils
ENV 3700: Mountain Environments

D. Mountain Ecosystems
   1. Vegetation
      a. Forests
      b. Timberline
      c. Tundra
   2. Wildlife
      a. Limiting factors
      b. Survival strategies
      c. Morphological and Physiological Adaptations

II. Field trip to Rocky Mountain National Park
   A. Geologic History of the Park
   B. Landforms and processes identification
   C. Vegetation Recognition

III. Designing a Research Proposal
   A. Identifying a Topic
   B. Literature Review
   C. Problem Statement
   D. Objectives
   E. Proposed Methods
   F. Expected Results

IV. Environmental Change
   A. Proxy Data
   B. Change in the distant past
   C. Environments during the last major glaciation
   D. Environments during the Holocene
   E. Climatic Change in the 21st century
   F. Future Change
      1. Environmental pollution
      2. Land use change
      3. Climate change
   G. Impacts
      1. Hydrology
      2. Cryosphere
      3. Extreme Events
      4. Ecological Systems
      5. Tourism

V. Managing Mountains
   A. Adaptation Strategies
   B. Policy Response

Evaluation of Student Performance:

1. Examinations
2. In-class exercises
3. Journal Articles or Readings Discussions
4. 10 – 15 page Research proposal
REGULAR COURSE SYLLABUS

School of: Letters, Arts, and Sciences
Department: Earth and Atmospheric Sciences
CIP Code: 03.0104
Prefix & Course Number: ENV 3710 Crosslisted With*: None
Course Title: Environmental Remediation

Check All That Apply: Required for Major: _____ Required for Minor: _____ Specified Elective: X
Required for Concentration: X Elective: X Service Course: _____

Credit Hours: 3 (2 + 0)

Total Contact Hours per semester (assuming 15-16 week semester):
Lecture 45 Lab _____ Internship _____ Practicum _____ Other (please specify type and hours): ____

Schedule Type(s): L Grading Mode(s): L
Variable Topics Courses: N/A
** NOTE: This information must be included in the course description.
Restrictions (Variable Topics Course): N/A
Prerequisite(s): ENV 1200, BIO 1091, CHE 1800, and at least junior standing; or permission of instructor
Corequisite(s): None
Prerequisite(s) or Corequisite(s): None

Banner Enforced:
Prerequisite(s): ENV 1200, BIO 1091, CHE 1800
Corequisite(s): None
Prerequisite(s) or Corequisite(s): None

Catalog Course Description:
This course presents technologies available for reclaiming contaminated sites and reducing health risks. Physical, chemical, and biological technologies will be examined for the cleanup of hazardous wastes. Students will integrate the nature of hazardous wastes, the behavior of chemicals at the surface and subsurface, and technological applications. Students will design a monitoring program for assessing the applicability of site cleanup and analyze the data from a site monitoring program.

APPROVED:

Department Chair OR Program Director

Dean OR Associate Dean

Associate VP, Academic Affairs
ENV 3710: Environmental Remediation

Required Reading and Other Materials will be equivalent to:

Natural and Enhanced Remediation Systems (Geraghty & Miller Environmental Science and Engineering Series.)


Specific, **Measurable** Student Behavioral Learning Objectives:

Upon completion of this course, students will be able to:

1. Describe the basic science and mathematics of chemical contamination remediation.
2. Distinguish among the various methods used in site remediation and restoration tasks.
3. Evaluate contaminated soil and groundwater and identify appropriate protection and remediation strategies for contaminated soil and waste disposal activities.
4. Diagnose remediation action cleanup programs.
5. Examine the practical implementation of remedial measures using published case studies.
6. Manage the various roles of important players in environmental remediation with an emphasis on the role of the expert consultant.

Detailed Outline of Course Content:

I. Hazardous Wastes Pollution and Evolution of Remediation
   A. The Concept of Risk
   B. Evolution of Understanding of Fate and Transport in Natural Systems
   C. Evolution of Remediation Technologies

II. Contaminant and Environmental Characteristics
   A. Contaminant Characteristics
   B. Environmental Characteristics

III. Monitored Natural Attenuation
   A. Approaches for Evaluating Natural Attenuation
   B. Patterns vs. Protocols
   C. Processes Affecting Natural Attenuation of Compounds
   D. Monitoring and Sampling for Natural Attenuation

IV. In Situ Reactive Zones
   A. Engineered Anaerobic Systems
   B. Engineered Aerobic Systems
   C. In Situ Chemical Oxidation Systems
   D. Nano-Scale Fe (0) Colloid Injection within an IRZ

V. Phytoremediation
   A. Chemicals in the Soil-Plant System
   B. Types of Phytoremediation
   C. Phytoremediation Design
VI. Constructed Treatment Wetlands
   A. Types of Constructed Wetlands
   B. Microbial and Plant Communities of a Wetland
   C. Wetland Soils
   D. Contaminant Removal Mechanisms
   E. Treatment Wetlands for Groundwater Remediation

VII. Engineered Vegetative Landfill Covers
   A. Historical Perspective on Landfill Practices
   B. The Role of Caps in the Containment of Wastes
   C. Conventional Landfill Covers
   D. Landfill Dynamics

VIII. Alternative Landfill Cover Technology
   A. Phyto-Cover Technology
   B. Phyto-Cover Design
   C. Cover System Performance
   D. Example ApplicationS
   E. Phyto-Cover Water Balance
   F. General Phyto-Cover Maintenance Activities
   G. Operation and Maintenance (O&M) Schedule
   H. Specific Operational Issues

Evaluation of Student Performance:

1. Examinations
2. Quizzes
3. Technical report reviews and discussions
4. 10-15 page Term paper
REGULAR COURSE SYLLABUS

School of: Letters, Arts, and Sciences

Department: Earth and Atmospheric Sciences

CIP Code: 03.0104

Prefix & Course Number: ENV 3720 Crosslisted With*: None

Course Title: Waste Management

Check All That Apply: Required for Major: ___ Required for Minor: ___ Specified Elective: X

Required for Concentration: X Elective: X Service Course: ___

Credit Hours: 3 (3 + 0)

Total Contact Hours per semester (assuming 15-16 week semester):

Lecture 45 Lab _____ Internship _____ Practicum _____ Other (please specify type and hours): ______

Schedule Type(s): L Grading Mode(s): L

Variable Topics Courses: N/A

** NOTE: This information must be included in the course description.

Restrictions (Variable Topics Course): N/A

Prerequisite(s): ENV 1200, BIO 1091, CHE 1800, and at least junior standing; or permission of instructor

Corequisite(s): None

Prerequisite(s) or Corequisite(s): None

Banner Enforced:

Prerequisite(s): ENV 1200, BIO 1091, CHE 1800

Corequisite(s): None

Prerequisite(s) or Corequisite(s): None

Catalog Course Description:

Waste generation, human health, waste treatment, disposal methods, recycling as well as environmental hazards will be examined in this course. Students will research the policies that govern transportation and disposal of waste. Laws and agency regulations will be examined to determine their effectiveness in reducing, remediating, and containing waste.

APPROVED:

Department Chair OR Program Director

Dean OR Associate Dean

Associate VP, Academic Affairs
ENV 3720: Waste Management

Required Reading and Other Materials will be equivalent to:


Specific, Measurable Student Behavioral Learning Objectives:

Upon completion of this course the student should be able to:
1. Define and identify the characteristics of solid waste materials.
2. Interpret important environmental laws and regulations that govern the management of waste.
3. Examine the concepts of risk assessment and remediation standards with respect to waste management.
5. Assess the advantages and disadvantages of various solid waste disposal techniques.

Detailed Outline of Course Content:

I. Perspectives
   A. Evolution of Solid Waste Management
   B. Legislative Trends and Impacts

II. Sources, Composition, and Properties of Solid Waste
   A. Sources, Types, and Composition of Municipal Solid Waste
   B. Physical, Chemical, and Biological Properties of Municipal Solid Waste
   C. Sources, Types and Properties of Hazardous Wastes Found In Municipal Solid Waste

III. Engineering Principles
   A. Generation of Solid Wastes
   B. Waste Handling and Separation, Storage, and Processing at the Source
   C. Collection of Solid Wastes
   D. Separation and Processing and Transformation of Waste Materials
   E. Transfer and Transport
   F. Disposal and Solid Wastes and Residual Matter

IV. Separation, Transformation, and Recycling of Waste Materials
   A. Materials Separation and Processing Technologies
   B. Thermal Conversion Technologies
   C. Biological and Chemical Conversion Technologies
   D. Recycling of Materials Found in Municipal Solid Waste
   E. Closure, Restoration, and Rehabilitation of Landfills
   F. Remedial Actions for Abandoned Waste Disposal Sites

V. Solid Waste Management and Planning Issues
   A. Meeting Federal and State Mandated Diversion Goals
   B. Implementation of Solid Waste Management Options
   C. Planning, Siting, and Permitting of Waste Management Facilities
Evaluation of Student Performance:
1. Examinations
2. Quizzes
3. Technical report reviews and discussions
4. 10-15 page Term paper
REGULAR COURSE SYLLABUS

School of: Letters, Arts, and Sciences

Department: Earth and Atmospheric Sciences

CIP Code: 03.0104

Prefix & Course Number: ENV 3730 Crosslisted With*: None

Course Title: Environmental Risk Assessment

Check All That Apply: Required for Major: ___ Required for Minor: ___ Specified Elective: X

Required for Concentration: X Elective: X Service Course: ____

Credit Hours: 3 (3 + 0)

Total Contact Hours per semester (assuming 15-16 week semester):

   Lecture 45   Lab ____  Internship ____  Practicum ____  Other (please specify type and hours): ____

Schedule Type(s): L  Grading Mode(s): L

Variable Topics Courses (list restrictions, including the maximum number of hours that can be earned**): N/A

** NOTE: This information must be included in the course description.

Restrictions (Variable Topics Course): N/A

Prerequisite(s): ENV 1200, 9 hours in any combination of Environmental Science, Geology, Physical Geography, Biology, Chemistry, and Meteorology courses, and at least junior standing; or permission of instructor

Corequisite(s): None

Prerequisite(s) or Corequisite(s): None

Banner Enforced:

Prerequisite(s): ENV 1200
Corequisite(s): None
Prerequisite(s) or Corequisite(s): None

Catalog Course Description:
Risk is an important component of regulatory decision making. Since risk assessment has no “correct” answers, this course explores what risk perception, risk management, and risk communication mean. Students will learn how to weigh the costs and benefits of risk reduction and how to evaluate the uncertainties in risk estimates. Case studies will be used to help explain principles.

APPROVED:

Department Chair OR Program Director 12/01/08

Dean OR Associate Dean 12-2-08

Associate VP, Academic Affairs 12/8/08
Environmental Risk Assessment

Required Reading and Other Materials will be equivalent to:


Specific, Measurable Student Behavioral Learning Objectives:

Upon successful completion of this course, the student will be able to:

1. Analyze the concept of risk as applied to environmental project planning.
2. Contrast how risk is incorporated into the planning stages to aid in the successful completion of large-scale environmental engineering projects.
3. Apply the concept of risk to hypothetical situations.
4. Design the concept of statistical decision-making and illustrate its use in project planning and outcome prediction.
5. Classify methods for the development site remediation and restoration tasks.
6. Diagnose problems based on remediation action cleanup programs/case studies.

Detailed Outline of Course Content:

I. Risk Assessment Primer
II. Regulatory Issues in Risk Assessment
   A. Survey of Health Risk Assessment
   B. Risk, Science, and Democracy
III. Basics of Risk Assessment
   A. Basics of Toxicology
   B. Risk Assessment in the Federal Government
   C. Site Characterization/Hazard Identification
   D. Exposure Assessment
   E. Carbon Dioxide Development and the Influence of Rising Groundwater in the Cospuden/Zwenkau Case Study
IV. Survey of Health Risk Assessment
   A. Quantitative Risks of Death and Sickness from Toxic Contamination Case Study
V. Risk Characterization
   A. Human Health Risk Assessment Case Study
   B. Restoration of lignite minings sites in the former GDR
VI. Risk Perception
   A. Love Canal Case Study
   B. Informing and Educating the Public About Risk
   C. Risks of Damage from Flooding Rivers Case Study
VII. Risk Communication
   A. Hamburger Hell
   B. Assessing the Risk of an LNG Terminal Case Study
   C. Case Study of a highly dioxin contaminated sports field
VIII. Ecological Risk Assessment
   A. Ecological Risk Assessment Guidance for Superfund
B. A Review of Ecological Assessment Case Studies from a Risk Assessment Perspective Case Study
C. Heavy Metal Contamination Removal by Bacterial Activity in Sleeping Depositories Case Study

IX. Risk Management
A. Risk Analysis: Understanding “How Safe is Safe Enough?”
B. Use of Precautionary Assumptions
C. ASARCO Case Study
D. Land Use and Remedy Selection Case Study

X. Improving Risk Assessment and Course Conclusion

Evaluation of Student Performance:

1. Written examinations
2. Case-study discussions
3. Quizzes
4. Exercises
5. 10 – 15 page term paper
6. Presentations
REGULAR COURSE SYLLABUS

School of: Letters, Arts, and Sciences

Department: Earth and Atmospheric Sciences

CIP Code: 03.0104

Prefix & Course Number: ENV 3740 Crosslisted With*: None

Course Title: Environmental Health

Check All That Apply: Required for Major: ____ Required for Minor: ____ Specified Elective: X

Required for Concentration: X Elective: X Service Course: _____

Credit Hours: 3 (2 + 0)

Total Contact Hours per semester (assuming 15-16 week semester):
Lecture 45 Lab ____ Internship ____ Practicum ____ Other (please specify type and hours): ____

Schedule Type(s): L Grading Mode(s): L

Variable Topics Courses (list restrictions, including the maximum number of hours that can be earned**): N/A

** NOTE: This information must be included in the course description.

Restrictions (Variable Topics Course): N/A

Prerequisite(s): ENV 1200, BIO 1091, CHE 1800, and at least junior standing; or permission of instructor

Corequisite(s): None

Prerequisite(s) or Corequisite(s): None

Banner Enforced:
Prerequisite(s): ENV 1200, BIO 1091, CHE 1800
Corequisite(s): None
Prerequisite(s) or Corequisite(s): None

Catalog Course Description:
This course addresses local, regional and global environmental issues affecting human health and policies. Environmental toxins and carcinogens, impacts on human health, dose response, occupational health, and risk assessment strategies are discussed. A field trip to an environmental health agency is required.

APPROVED:

Department Chair OR Program Director

Dean OR Associate Dean

Associate VP, Academic Affairs
ENV 3740: Environmental Health

Required Reading and Other Materials will be equivalent to:


Frumkin, H., Editor. 2006: Environmental Health: from global to Local, A Wiley Imprint, 1066 pp.

As well as reading from various journal articles

Specific, Measurable Student Behavioral Learning Objectives:

Upon successful completion of this course, the student will be able to:

1. Define the major sources, types, transport, and fate of harmful environmental agents.
2. Identify the specific carriers or vectors that promote the transfer of these agents from the environment to humans.
3. Describe how these agents interact with biological systems and the mechanisms by which they exert adverse health effects.
4. Understand different local, regional, and global environmental health issues.
5. Illustrate the steps in the regulatory process in terms of risk assessment and risk management.
6. Identify current policies, legislation, and regulation regarding environmental issues.
7. Recognize significant gaps in the current knowledge base concerning the health effects of environmental agents.
8. Categorize areas of uncertainty in the risk-assessment process.
9. Organize an oral presentation based on analytical research reports.
10. Write a scientific research report.

Detailed Outline of Course Content:

I. Introduction
   A. Define environmental health
   B. Brief historical perspective
   C. Relationship of people to their environment
   D. Determinants of health
   E. Causative agents of diseases
   F. Transmission of communicable diseases
   G. Hazards due to exposure to biological, chemical, and physical materials in our environment

II. Toxic Chemicals and Human Health
   A. Behavior and effects of toxic chemicals released into the environment
   B. Sources, distribution, and fate of toxic chemicals in the environment
   C. Human health impacts of chemicals found in the workplace and general environment.
   D. Toxicology and environmental health paradigm
   E. Dose response relationship, disposition of toxicants
   F. Environmental toxicology
III. Environmental Health at the Global Scale
   A. Population pressure
   B. Climate Change
   C. War
   D. Developing nations

IV. Environmental Health at the Regional Scale
   A. Air pollution
   B. Energy Production
   C. Urbanization
   D. Transport and Health
   E. Water, wastewater and health

V. Environmental Health at the Local Scale
   A. Solid hazardous waste
   B. Pest control and pesticide
   C. Food safety
   D. Indoor air
   E. Workplace health and safety
   F. Radiation hazards

VI. Food Protection and Safety
   A. Food Safety and globalization
   B. Lifestyle, food safety and emerging food borne pathogens
   C. Identification and characteristics of chemicals and biological agents implicated in food borne disease outbreaks
   D. Circumstances by which food contamination occurs
   E. Food protection activities conducted by local and state governments at the retail level

VII. Environment Health Policy
   A. Introduction to environmental health policy
   B. Assessing environmental health risk
   C. Rational action and environmental health policy
   D. Making Policy

VIII. Environmental Health and Occupational Health Sciences Seminar
   A. Presentation of current environmental and occupational health research and issues.
   B. Discussion of current scientific literature articles/journals of particular relevance to the Environmental Health program.
   C. Presentation of case studies on environmental health events
   D. Review of impacts on local, regional, and global policy

IX. Writing a research report and oral presentation
   A. Identifying a Topic
   B. Outline
   C. Literature Review
   D. Analyze the problem
   E. Propose sustainable solutions
   F. Conclusions
   G. Report Submission
   H. Oral presentation
ENV 3740: Environmental Health

Evaluation of Student Performance:

1. Examinations
2. Group Presentations
3. Journal article or reading discussions
4. 15 – 20 page term paper
REGULAR COURSE SYLLABUS

School of: Letters, Arts, and Sciences

Department: Earth and Atmospheric Sciences

Prefix & Course Number: ENV 3920

Course Title: Directed Study in Environmental Science

Check All That Apply: Required for Major: _____ Required for Minor: _____ Specified Elective: X

Required for Concentration: _____ Elective: X Service Course: _____

Credit Hours: 2-6 (0+4-12)

Total Contact Hours per semester (assuming 15-16 week semester):

Lecture 0 Lab 60-180 Internship _____ Practicum _____ Other (please specify type and hours): ______

Schedule Type(s): A Grading Mode(s): L

Variable Topics Courses (list restrictions, including the maximum number of hours that can be earned**): N/A

** NOTE: This information must be included in the course description.

Restrictions (Variable Topics Course): N/A

Prerequisite(s): at least junior standing in environmental science, geology, or land use; approval of the instructor and department chair.

Corequisite(s): None

Prerequisite(s) or Corequisite(s): None

Banner Enforced:

Prerequisite(s): Approval of Department Chair
Corequisite(s): None
Prerequisite(s) or Corequisite(s): None

Catalog Course Description:

This course provides an opportunity for upper-division students with a strong background in Environmental Science to pursue a specific research topic of interest with a faculty member. The course requires permission of the instructor and chair of the Earth and Atmospheric Sciences Department.

APPROVED:

Dean OR Associate Dean Date

Associate VP, Academic Affairs Date

*If crosslisted, attach completed Course Crosslisting Agreement Form
**Required Reading and Other Materials will be equivalent to:**

Necessary reading materials will correspond to the research project being undertaken.

**Specific, Measurable Student Behavioral Learning Objectives:**

Upon completion of this course, the student will be able to:

1. Conduct a literature review
2. Develop a research methodology
3. Acquire the necessary data
4. Analyze and interpret results
5. Write a high-quality scientific report

**Detailed Outline of Course Content (Major Topics and Subtopics) or Outline of Field Experience/Internship (experience, responsibilities and supervision):**

Content will vary depending on student projects.

**Evaluation of Student Performance:**

Students will be evaluated on a combination of the following:

1. Progress reports
2. Final research paper
3. Final research presentation
REGULAR COURSE SYLLABUS

School of: Letters, Arts and Sciences
Department: Earth and Atmospheric Sciences
Prefix & Course Number: ENV 4000  Crosslisted With*: n/a
Course Title: Environmental Geology
Banner course title (30 characters): Environmental Geology
Check All That Apply: Required for Major: x  Required for Minor:  Specified Elective: x
Required for Concentration: x  Service Course: __

To receive Title IV financial aid funds, all institutions of higher education must comply with the federal definition of a credit hour. The Higher Learning Commission requires institutions to maintain policies and procedures for verifying compliance with this definition.

**Federal Credit Hour Definition:** A credit hour is an amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally-established equivalency that reasonably approximates not less than:
(1) one hour of classroom or direct faculty instruction and a minimum of two hours of out-of-class student work each week for approximately fifteen weeks for one semester or trimester hour of credit, or ten to twelve weeks for one quarter hour of credit, or the equivalent amount of work over a different amount of time; or (2) at least an equivalent amount of work as required in paragraph (1) of this definition for other activities as established by an institution, including laboratory work, internships, practica, studio work, and other academic work leading toward the award of credit hours. 34CFR 600.2 (11/1/2010)

Credit Hours: 3 (2+2)

Face-to-Face or Equivalent Hours per course:
Lecture 30  Lab 30  Internship 0  Practicum 0  Other (please specify type and hours): 0
Additional Student Work Hours per course: __

Schedule Type:  Grade Mode: L
Variable topics umbrella course:  No x Yes  If Yes, number of credit hours allowed __
Specified repeatable course: No __  Yes ____

APPROVED:  

Department Chair / Program Director  
Date

Dean / OR Associate Dean  
Date

Associate VP, Academic and Student Affairs  
Date

*If crosslisted, attach completed Course Crosslisting Agreement Form
Prefix and Course Number: ENV 4000

Prerequisite(s): GEL 1010, GEL 3120, and GEL 3420
Corequisite(s): NONE
Prerequisite(s) or Corequisite(s): N/A

Banner Enforced:
Prerequisite(s): GEL1010, GEL3120, and GEL3420
Corequisite(s): NONE
Prerequisite(s) or Corequisite(s): __

Registration restrictions: Level _____ Class _____ Program/Major _____ Student attribute ____

Catalog Course Description:
The close relationship of the environment to the geology of the Earth is examined. Basic geology, geologic processes, and geologic techniques are applied to the environment in a series of practical problems. Interpretation of topographic and geologic maps is required. Natural geologic hazards are revealed in a series of actual case studies performed by the student.

Specific Variable Topics Course Description (if applicable, umbrella course description included above):

Required Reading and Other Materials will be equivalent to:

Specific, Measurable Student Behavioral Learning Objectives:
Upon completion of this course the student should be able to:
1. Understand and assess the fundamental environmental concepts
2. Relate Natural Geologic processes to the various natural hazards and environmental problems
3. Predict the occurrence of natural hazards and environmental problem;
4. Evaluate the interactions between humans and environment;
5. Analyze the cultural basis for environmental awareness
6. Debate people’s awareness and perception of natural hazards and environmental problems
7. Relate geology and natural hazards to land use planning; and
8. Choose prepare and present a paper on some aspect of environmental geology

Detailed Outline of Course Content (Major Topics and Subtopics) or Outline of Field Experience/Internship (experience, responsibilities and supervision) :
I. Philosophy and Fundamental Principles
   a. Cultural basis for environmental awareness
   b. Fundamental concepts
   c. Earth materials and processes
   d. Soils and environment
II. Hazardous Earth Processes
    a. An overview of natural hazards
    b. River flooding
    c. Landslides
    d. Earthquakes
    e. Volcanic activity
    f. Costal hazards
III. Human Interaction with the Environment
     a. Landscape Evaluation
     b. Waste disposal
     c. The geologic aspects of environmental health
IV. Minerals, Energy, and the Environment
    a. Mineral resources and the environment
    b. Energy and the environment
V. Land Use and Decision Making
   a. Landscape Evaluation
   b. Environmental law
Evaluation of Student Performance:
   Exams
   Term paper
   Presentation
   Poster display
REGULAR COURSE SYLLABUS

School of: Letters, Arts, and Sciences
Department: Earth and Atmospheric Sciences
CIP Code: 03.0104
Prefix & Course Number: ENV 4010  Crosslisted With*: None
Course Title: Environmental Hazards and GIS
Check All That Apply: Required for Major: ____ Required for Minor: ____ Specified Elective: X
Required for Concentration: X Elective: X Service Course: ____
Credit Hours: 3 (2 + 2)
Total Contact Hours per semester (assuming 15-16 week semester):
Lecture 30  Lab 30  Internship ____  Practicum ____  Other (please specify type and hours): 
Schedule Type(s): L  Grading Mode(s): L
Variable Topics Courses (list restrictions, including the maximum number of hours that can be earned**):
N/A
** NOTE: This information must be included in the course description.
Restrictions (Variable Topics Course): N/A
Prerequisite(s): ENV 4000 and GIS 2250; GEG 3610 recommended
Corequisite(s): None
Prerequisite(s) or Corequisite(s): None
Banner Enforced:
Prerequisite(s): GIS 2250
Corequisite(s): None
Prerequisite(s) or Corequisite(s): None
Catalog Course Description:
This course evaluates environmental hazards relative to various land-use patterns. It utilizes case studies and Geographical Information Systems (GIS) to examine hazards and prepare models.
APPROVED:

Department Chair or Program Director

Dean or Associate Dean

Associate VP, Academic Affairs
ENV 4010: Environmental Hazards and GIS

Required Reading and Other Materials will be equivalent to:


Specific, Measurable Student Behavioral Learning Objectives:

Upon completion of this course the student should be able to:

1. Evaluate how personalities affect the planning process (individual and team approaches).
2. Examine potential environmental hazards and explain how they are incorporated into planning documents.
3. Prepare a literature review and bibliography on an environmental hazard topic.
4. Evaluate environmental hazards within the context of the planning process.
5. Assess alternative land use planning options to deal with the hazard(s).
6. Create a site plan for a preferred alternative.
7. Analyze hazards with the use of Geographic Information System (GIS) technology.

Detailed Outline of Course Content:

I. Introduction
   A. Environmental and ecological planning
   B. Continuum of environmental planning

II. Case Studies of Environmental Hazards
   A. Flooding
   B. Swelling soils
   C. Earthquakes
   D. Coastal erosion
   E. Water issues
   F. Waste disposal
   G. Environmental health
   H. Mineral development
   I. Slopes, slides, and avalanches

III. Factors Affecting Environmental Planning
   A. Human activity, politics, and values
   B. Zoning
   C. Economics
   D. Technology - GIS
   E. Geology and Physiography
   F. The planner's personal footprint in the process

IV. The Eleven Step GIS Planning Method
   A. Issue identification and goal establishment
   B. Inventory and analysis of the biophysical environment
   C. Human community inventory and analysis
   D. Suitability analysis
   E. Planning options and choices
   F. Landscape plans
   G. Continuing citizen involvement and community education
   H. Plan and design implementation

V. Administration of planning programs
VI. GIS Hazard Analysis Projects and Presentations
ENV 4010: Environmental Hazards and GIS

Evaluation of Student Performance:
1. Examinations
2. In-class exercises
3. GIS Assignments
5. GIS project presentation
REGULAR COURSE SYLLABUS

School of: Letters, Arts and Sciences

Department: Earth and Atmospheric Sciences

Prefix & Course Number: ENV 4200 Crosslisted With*: n/a

Course Title: Environmental Policy and Planning

Banner course title (30 characters): Env Policy and Planning

Check All That Apply: Required for Major: x  Required for Minor: ___ Specified Elective: ___

Required for Concentration: x  Elective: x  Service Course: ___

To receive Title IV financial aid funds, all institutions of higher education must comply with the federal definition of a credit hour. The Higher Learning Commission requires institutions to maintain policies and procedures for verifying compliance with this definition.

Federal Credit Hour Definition: A credit hour is an amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally-established equivalency that reasonably approximates not less than:
(1) one hour of classroom or direct faculty instruction and a minimum of two hours of out-of-class student work each week for approximately fifteen weeks for one semester or trimester hour of credit, or ten to twelve weeks for one quarter hour of credit, or the equivalent amount of work over a different amount of time; or (2) at least an equivalent amount of work as required in paragraph (1) of this definition for other activities as established by an institution, including laboratory work, internships, practica, studio work, and other academic work leading toward the award of credit hours. 34CFR 600.2 (11/1/2010)

Credit Hours: 3 (3+0)

Face-to-Face or Equivalent Hours per course:

Lecture 45  Lab ___  Internship ___  Practicum ___  Other (please specify type and hours):

Additional Student Work Hours per course: ___

Schedule Type: L  Grade Mode: L

Variable topics umbrella course: No x Yes ___  If Yes, number of credit hours allowed ___

Specified repeatable course: No ___ Yes ___

APPROVED:

Department Chair OR Program Director

Dean OR Associate Dean

Associate VP, Academic and Student Affairs

*If crosslisted, attach completed Course Crosslisting Agreement Form
Prefix and Course Number: ENV 4200

Prerequisite(s): ENV 1200 and completion of General Studies

Corequisite(s): NONE

Prerequisite(s) or Corequisite(s): NONE

Banner Enforced:
Prerequisite(s): ENV 1200 and completion of General Studies
Corequisite(s): NONE
Prerequisite(s) or Corequisite(s): NONE

Registration restrictions: Level Class Program/Major Student attribute

Catalog Course Description:
This course provides an overview of environmental policy and major environmental laws in the U.S. The major statutes are analyzed in terms of purpose, scope, implementation, compliance requirements, and impact on land use. Case studies are examined in a planning context.

Required Reading and Other Materials will be equivalent to:

Printed materials will be provided by the Environmental Protection Agency (EPA), including
1. Summaries of environmental laws administered by EPA
2. Summaries of each major act

Specific, Measurable Student Behavioral Learning Objectives:
Upon completion of this course the student should be able to:
1. Evaluate major pieces of environmental legislation;
2. Analyze current issues in environmental management within a planning context;
3. Identify the requirements of an environmental impact statement (EIS) and evaluate a selected document;
4. Relate environmental policy and law to current land use issues;
5. Relate environmental policy and law to emerging global issues, such as global climate change and chlorofluorocarbons; and
6. Prepare written evaluations of selected statutes and their relationship to planning.

Detailed Outline of Course Content (Major Topics and Subtopics) or Outline of Field Experience/Internship (experience, responsibilities and supervision):

I. Why do we have environmental policies and laws?
   a. Public policy cycle
   b. Historical development of environmental policy and law

II. Current Legal Framework for Environmental Management
   a. Clean Air Act
   b. Clean Water Act
   c. Ocean Dumping Act
   d. Safe Drinking Water Act
   e. Resource Conservation and Recovery Act (RCRA)
   f. Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, aka Superfund)
   g. Federal Insecticide, Fungicide, and Rodenticide Act
   h. Toxic Substances Control Act
   i. Environmental Research and Development Demonstration Act
   j. National Environmental Policy Act (NEPA)
   k. Federal Emergency Management Act (FEMA) and Urban drainage and Flood control Act
   l. Mined Land Reclamation Act

III. Current Topics and Case Studies
   a. Mineral development and energy policy
   b. Land use, wilderness, and wildlife
   c. Water resources: Allocation and development
      i. Western water policy
      ii. Colorado’s in-stream flow program
d. Water quality control: standard setting  
e. Water quality control: Implementation and enforcement  
f. Regulation of toxic substances: superfund legislation  
g. Global warming  
  i. The greenhouse effect  
  ii. Politics and the air around us  
  iii. Agenda setting and public policy  

IV. Above Case Studies Examined in a Planning Context  
a. The role of planning in the compliance process  
b. Severity of the effects of the environmental problem  
c. Extent of population and environment which will be affected  
d. Geographic extent  
e. Direct and indirect effects  
f. Risk assessment  
g. Controllability: technological, social, political, and economic  
h. Mitigation of current problems  
i. Planning to avoid future problems  

Evaluation of Student Performance:  
Examinations  
Papers  
Projects  
Presentations  
Additional exercises as required by the instructor
REGULAR COURSE SYLLABUS

School of: Letters, Arts, and Sciences

Department: Earth and Atmospheric Sciences

CIP Code: 03.0104

Prefix & Course Number: ENV 4400  Crosslisted With*: ______

Course Title: Landscape Ecology

Check All That Apply:  Required for Major: X  Required for Minor: ____  Specified Elective: X

Required for Concentration: ____  Elective: X  Service Course: ____

Credit Hours: 2 (3 + 0)

Total Contact Hours per semester (assuming 15-16 week semester):
- Lecture 45  Lab ____  Internship ____  Practicum ____  Other (please specify type and hours): ____

Schedule Type(s): L  Grading Mode(s): L

Variable Topics Courses: N/A

** NOTE: This information must be included in the course description.

Restrictions (Variable Topics Course): N/A

Prerequisite(s): ENV 1200, GIS 2250, and ENV 4430; or permission of instructor

Corequisite(s): None

Prerequisite(s) or Corequisite(s): None

Banner Enforced:
Prerequisite(s): ENV 1200, GIS 2250, ENV 4430
Corequisite(s): None
Prerequisite(s) or Corequisite(s): None

Catalog Course Description:
Students will examine the effects of spatial pattern and scale on ecological processes. Concepts, tools, and techniques that enhance the effectiveness of watershed and ecosystem management, design of green infrastructure, and smart growth are explored. Students will learn how the concepts of landscape ecology apply to environmental policy, management, regulation, and assessment.

APPROVED:  

Department Chair OR Program Director  Date  

Dean OR Associate Dean  Date  

Associate VP, Academic Affairs  Date
ENV 4400 Landscape Ecology

Required Reading and Other Materials will be equivalent to:


Additional readings from journal articles will be required.

Specific, Measurable Student Behavioral Learning Objectives:

Upon successful completion of this course, students will be able to:
1. Describe the current research trends in the field of landscape ecology.
2. Judge the landscape according to various ecological endeavors.
3. Assess the various methods used to detect landscape patterns.
4. Collect and measure spatial ecological data with GIS, remote sensing, and GPS Technology.
5. Present scientific information to their peers.

Detailed Outline of Course Content:

I. Introduction and concepts
   A. Landscape elements
II. Pattern and scale
   A. Detecting scales of variation – spatial pattern
   B. Populations
   C. Communities
   D. Ecosystems
III. Remote sensing for analysis of landscapes
   A. Case Studies
IV. Textual measures as indices of pattern
   A. Physical processes
   B. Biological processes
V. GIS applications in landscape ecology
   A. Case studies
VI. Temporal change and landscape pattern
   A. Land use change
   B. Disturbances
VII. Fractal models and landscape ecology
   A. Landscape structure
      1. Patchiness and patches
      2. Levels of patchiness
      3. Components of structure
   B. Landscape structure
      1. Landscape metrics
      2. Gradient concept of landscape structure
VIII. Dynamic spatial models
   A. Pattern, process, and predictability
IX. Integrating economics
   A. Landscape planning
   B. Translating across scales
X. Future directions
XI. Student Presentations
ENV 4400 Landscape Ecology

Evaluation of Student Performance:

1. Examinations
2. Quizzes
3. GIS and remote sensing exercises
4. Journal Article Discussions
5. Research project presentation
6. Research project (10 – 15 page term paper)
REGULAR COURSE SYLLABUS

School of:  Letters, Arts and Sciences

Department:  Earth and Atmospheric Sciences

CIP Code:  45.0701

Prefix & Course Number:  ENV 4410

Crosslisted With*:  None  HON 4410

Course Title:  Water Law

Check All That Apply:  Required for Major:  _____  Required for Minor:  _____  Specified Elective:  X

                    Required for Concentration:  _____  Elective:  X  Service Course:  _____

Credit Hours:  3  (3 + 0)

Total Contact Hours per semester (assuming 15-16 week semester):

Lecture 45  Lab 0  Internship 0  Practicum 0  Other (please specify type and hours):  0

Schedule Type(s):  L  Grading Mode(s):  L

Variable Topics Courses (list restrictions, including the maximum number of hours that can be earned*):  N/A

*NOTE: This information must be included in the course description.

Restrictions (Variable Topics Course):  N/A

Prerequisite(s):  ENV 1200 or ENV 1400 or ENV 3400 or permission of instructor

Corequisite(s):  None

Prerequisite(s) or Corequisite(s):  None

Banner Enforced:
Prerequisite(s):  None
Corequisite(s):  None
Prerequisite(s) or Corequisite(s):  None

Catalog Course Description: This course surveys U.S. water law and administration. Topics include (1) why we need laws regulating water use, (2) how ancient water laws influenced U.S. water law, (3) variations of surface and groundwater law, including prior appropriation, riparian, and hybrid, (4) international and interstate agreements, and (5) a special focus on water administration in the West.

APPROVED:

8/2/06

Department Chair OR Program Director

3/6/07

Dean OR Associate Dean

9/18/07

Associate VP, Academic Affairs
Prefix and Course Number: ENV 4410

Required Reading and Other Materials will be equivalent to:


Specific, *Measurable* Student Behavioral Learning Objectives:

Upon completion of this course the student should be able to:

1. evaluate water law back to Islamic, Napoleonic, French, and English civil law;
2. recount the history of water-law adoption in climatically diverse areas of the U.S.;
3. illustrate basic tenets of Riparian water law, Prior Appropriation law, and Hybrid law and identify states that follow each;
4. discuss the variations on rights to use the surface of waterways;
5. differentiate between types of groundwater law and which areas of U.S. rely more heavily on groundwater;
6. describe diffused surface waters and analyze who may have rights to them;
7. compare and evaluate the importance of federal reserved water rights for federal properties and Indian reservations;
8. examine the circumstances that give the federal government power in water issues greater than a state's powers over their waters;
9. assess interstate problems with water and how they can be solved through litigation or state compacts;
10. appraise the various water organizations and their level of power, funding, and purpose; and
11. analyze the trend of water-rights formulation through time and contrast the utility of using existing water laws with the new pressures for growth in the dry West.

Detailed Outline of Course Content (Major Topics and Subtopics or Outline of Field Experience/Internship (experience, responsibilities and supervision)):

I. Ancient History of Water Laws
   11. Riparian
       A. Riparian states
       B. Climate
       C. Apportionment of water
       D. Distribution of burden in times of shortage
   111. Prior Appropriation
        A. Prior Appropriation states
        B. Climate
        C. Apportionment of water
        D. Distribution of burden in times of shortage
   IV. Hybrid
     A. Hybrid states
     B. Climate
     C. Apportionment of water
     D. Distribution of burden in times of shortage
   V. Rights of Use of Water Surfaces
      A. Relationship of "navigable" surface-waters definition
   VI. Groundwater
      A. Rule of capture
      B. Conjunctive use
      C. Tributary and non-tributary
      D. Designated basins
   VII. Diffused Surface Waters
      A. Rights to sheetflow and precipitation
      B. Cloud seeding
   VIII. Federal Reserved Rights
      A. Indian reservations
      B. National parks, wilderness areas, Bureau of Land Management lands, etc.
   IX. Federal Power
      A. Defense
B. Interstate commerce

X. Interstate Water Problems
   A. Litigation
   B. Interstate compacts
   C. 1922 Colorado River Compact

XI. Water Organizations
   A. Functions
   B. Statutory authority

XII. Future Problems in Water Law

Evaluation of Student Performance:

A minimum of 2 examinations, a written paper, and any projects, presentations, or exercises required by the instructor.
Metropolitan State College of Denver

COURSE CROSSLISTING AGREEMENT REQUEST

This is to confirm that the undersigned have met, discussed, and agreed that the following course be crosslisted as follows:

**Original/Standing Course:**

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Course Number</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENV</td>
<td>4410</td>
<td>Water Law</td>
</tr>
<tr>
<td></td>
<td>PRIMARY COURSE OWNER (Dept.):</td>
<td>Environmental Science</td>
</tr>
</tbody>
</table>

**Course to be crosslisted with (one or more courses):**

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Course Number</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>HON</td>
<td>4410</td>
<td>Water Law</td>
</tr>
</tbody>
</table>

Beginning **Spring 2013** (semester and year).

**Approvals:**

Department Chair OR Institute Director

Department Chair OR Program Director

Dean OR Associate Dean

Dean OR Associate Dean

Office of Academic Affairs Designee

Please forward the completed form to the Office of Academic Affairs for processing (CN 318, Box 48). It will remain in force until rescinded by one of the parties using the Crosslisting Termination Form.
REGULAR COURSE SYLLABUS

School of: Letters, Arts and Sciences

Department: Earth and Atmospheric Sciences

Prefix & Course Number: ENV4420  Crosslisted With*: n/a

Course Title: Wetlands

Banner course title (30 characters): Wetlands

Check All That Apply: Required for Major: _____ Required for Minor: _____ Specified Elective: x

Required for Concentration: _____ Elective: x Service Course: _____

To receive Title IV financial aid funds, all institutions of higher education must comply with the federal definition of a credit hour. The Higher Learning Commission requires institutions to maintain policies and procedures for verifying compliance with this definition.

**Federal Credit Hour Definition:** A credit hour is an amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally-established equivalency that reasonably approximates not less than:

1. one hour of classroom or direct faculty instruction and a minimum of two hours of out-of-class student work each week for approximately fifteen weeks for one semester or trimester hour of credit, or ten to twelve weeks for one quarter hour of credit, or the equivalent amount of work over a different amount of time; or
2. at least an equivalent amount of work as required in paragraph (1) of this definition for other activities as established by an institution, including laboratory work, internships, practica, studio work, and other academic work leading toward the award of credit hours. 34CFR 600.2 (11/1/2010)

Credit Hours: 3 (3+0)

Face-to-Face or Equivalent Hours per course:

Lecture 45  Lab _____ Internship _____ Practicum _____ Other (please specify type and hours):_____

Additional Student Work Hours per course: _____

Schedule Type:  L  Grade Mode:  L  

Variable topics umbrella course: No x Yes _____ If Yes, number of credit hours allowed _____

Specified repeatable course: No  Yes _____

APPROVED:

[Signature]

Date 9/26/13

Department Chair OR Program Director

[Signature]

Date 10/5/13

Dean OR Associate Dean

[Signature]

Date 12/6/13

Associate VP, Academic and Student Affairs

[Signature]

Date

*If crosslisted, attach completed Course Crosslisting Agreement Form
Catalog Course Description: this course offers a broad overview of wetland landscapes. Topics include: (1) Spatial distribution (local and national), (2) variations in wetlands topology (salt-water versus fresh-water and warmer versus colder climates), (3) relationships between wetlands (migratory flight paths), (4) wetlands ecosystems, (5) human impacts on wetlands, (6) federal state and local wetlands regulations, and (7) international wetlands problems.

Specific Variable Topics Course Description (if applicable, umbrella course description included above):

Required Reading and Other Materials will be equivalent to:

Specific, Measurable Student Behavioral Learning Objectives:
Upon completion of this course the student should be able to:
1. distinguish wetlands and understand the variations of definitions used;
2. analyze the global distribution of wetlands and the variations of definitions used;
3. contrast the variations of wetlands topology and the conditions that create each type;
4. explain various functions of wetlands and their utility for humans and the ecosystem;
5. describe general plant, animal, and human adaptations to wetlands;
6. assess anthropocentric impacts on wetlands from agriculture, industry, urbanization, and recreation;
7. discuss the global distribution and severity of wetlands losses;
8. evaluate the effects of political interests on the protection or destruction of wetlands;
9. appraise the various federal laws which now have some impact on wetlands (positive or negative);
10. identify major national and international organizations trying to protect wetlands;
11. evaluate the importance of migratory flight paths and the protection of wetlands along routes;
12. describe “created” wetlands and what uses to which they can be put;
13. criticize methods of wetlands restoration and list the basic steps that would be included; and
14. analyze and relate the current problems in Everglades National Park to land uses and public policy

Detailed Outline of Course Content (Major Topics and Subtopics) or Outline of Field Experience/Internship (experience, responsibilities and supervision):

I. What are Wetlands?
   a. Definitions
   b. Major differences between types of wetlands

II. Why do we need Wetlands?
   a. Description of functions
   b. Utility for humans
   c. Utility for ecosystems (plant and animal)

III. Adaptations
   a. Plant adaptations to waterlogged soils, little oxygen, and presence of saltwater
   b. Animal adaptations (appendages, e.g. beaks, feet, fins; altering environment, e.g. beaver dams and alligator holes)
   c. Human adaptations (harvesting for food, building materials, building styles and migration)

IV. Physical Characteristics and Distribution
   a. Saltwater versus freshwater
   b. Tidal influenced versus inland
   c. Presence or absence of groundwater (bogs versus fens)
   d. General description of plant types (mosses, sedges, grasses and trees)
   e. Distribution of different types of wetlands (geographically and climatically)

V. Temperate Wetlands
a. Wetlands types and distribution
b. Relationships between wetlands
c. Case studies

VI. Tropical Wetlands
   a. Wetlands types and distribution
   b. Population growth pressures

VII. Agricultural Impacts
   a. Temperature
   b. Population growth pressures

VII. Agricultural Impacts
   a. Temperate
   b. Tropical

VIII. Impact of Industrialization

IX. Impact of recreation
   a. Hunting and fishing
   b. Boating
   c. Skiing
   d. Tourism

X. Wetlands Losses
   a. Global distribution
   b. Severity
   c. Protection efforts implemented

XI. Regulations for Protection / destruction
   a. Federal
   b. State
   c. Local

Evaluation of Student Performance:
   Examinations
   Written paper
   Projects
   Presentations
   Exercises
REGULAR COURSE SYLLABUS

School of: Letters, Arts and Sciences
Department: Earth and Atmospheric Sciences
Prefix & Course Number: ENV 4430  Crosslisted With*: N/A
Course Title: Habitat Planning
Banner course title (30 characters): Habitat Planning
Check All That Apply:  Required for Major:  Required for Minor:  Specified Elective: 
Required for Concentration:  Elective:  Service Course: 

To receive Title IV financial aid funds, all institutions of higher education must comply with the federal definition of a credit hour. The Higher Learning Commission requires institutions to maintain policies and procedures for verifying compliance with this definition.

Federal Credit Hour Definition: A credit hour is an amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally-established equivalency that reasonably approximates not less than:
(1) one hour of classroom or direct faculty instruction and a minimum of two hours of out-of-class student work each week for approximately fifteen weeks for one semester or trimester hour of credit, or ten to twelve weeks for one quarter hour of credit, or the equivalent amount of work over a different amount of time; or (2) at least an equivalent amount of work as required in paragraph (1) of this definition for other activities as established by an institution, including laboratory work, internships, practica, studio work, and other academic work leading toward the award of credit hours. 34CFR 600.2 (11/1/2010)

Credit Hours:

Face-to-Face or Equivalent Hours per course:
Lecture 45  Lab  Internship  Practicum  Other (please specify type and hours):

Additional Student Work Hours per course: 

Schedule Type: L Grade Mode: L 
Variable topics umbrella course: No Yes If Yes, number of credit hours allowed 
Specified repeatable course: No Yes 

APPROVED:

Department Chair OR Program Director  Date 
Dean OR Associate Dean  Date 
Associate VP, Academic and Student Affairs  Date 

*If crosslisted, attach completed Course Crosslisting Agreement Form
Prerequisite(s): ENV 1200 and completion of General Studies
Corequisite(s): NONE
Prerequisite(s) or Corequisite(s): NONE
Banner Enforced:
Prerequisite(s): ENV 1200 and completion of General Studies
Corequisite(s): NONE
Prerequisite(s) or Corequisite(s): NONE

Registration restrictions: Level _____ Class _____ Program/Major _____ Student attribute _____

Catalog Course Description: This is an interdisciplinary course designed to examine the forces and impacts of urban expansion and ecological processes on wildlife habitat. Topics include conservation biology principles, problems with wildlife habitat conservation, and planning solutions to preserve wildlife habitats. Multiple spatial and political scales provide the context for analysis.

Specific Variable Topics Course Description (if applicable, umbrella course description included above):

Required Reading and Other Materials will be equivalent to:


Specific, Measurable Student Behavioral Learning Objectives:
Upon completion of this course the student should be able to:

1. Identify the many causes of species endangerment including urbanization and other land use problems.
2. Identify key pieces of national and international environmental legislation relevant to habitat planning.
3. Explain the concepts of habitat, biodiversity, and species.
4. Evaluate the paradigms of conservation biology including conservation genetics, island biogeography.
5. Debate the pros and cons of habitat management strategies and conservation legislation.
6. Identify wildlife habitat planning issues at local, state, national and international spatial scales.
7. Evaluate interdisciplinary and interagency contributions to identifying and solving wildlife habitat issues.
8. Present and discuss current trends and issues in wildlife habitat management
9. Research and evaluate wildlife habitat literature.

Detailed Outline of Course Content (Major Topics and Subtopics) or Outline of Field Experience/Internship (experience, responsibilities and supervision):

I. The History and Distinctions of Conservation Biology
II. The Legal Foundations of Conservation Biology
III. Biodiversity: Concepts, Measures, and Challenge
IV. The Historic and Foundational paradigms of Conservation Biology
V. The Conservation of Habitat and landscapes
VI. Ecosystem Management
VII. Examples of Habitat Management Approaches, Legislation, and Incentives for Conservation Planning

Evaluation of Student Performance:
Homework; Exams and quizzes; Papers and presentations
REGULAR COURSE SYLLABUS

School of: Letters, Arts, and Sciences

Department: Earth and Atmospheric Sciences

Prefix & Course Number: ENV 4440  Crosslisted With*: 

Course Title: Limnology

Check All That Apply: Required for Major: X  Required for Minor: ___  Specified Elective: X  Required for Concentration: X  Elective: X  Service Course: ___

Credit Hours: 3 (2+2)

Total Contact Hours per semester (assuming 15-16 week semester):
   Lecture 30  Lab 30  Internship ____  Practicum ____  Other (please specify type and hours): ____

Schedule Type(s): 1  Grading Mode(s): 1

Variable Topics Courses (list restrictions, including the maximum number of hours that can be earned**):

** NOTE: This information must be included in the course description.

Restrictions (Variable Topics Course): ____

Prerequisite(s): ENV 1200; BIO 1081; BIO 1091; or permission of the instructor

Corequisite(s): None

Prerequisite(s) or Corequisite(s):

Banner Enforced:
   Prerequisite(s): ENV 1200; BIO 1081; BIO 1091
   Corequisite(s): None
   Prerequisite(s) or Corequisite(s): None

Catalog Course Description:

This course examines the study of lakes, reservoirs, and ponds as inland water ecosystems. The physical, chemical, and biological components of inland waters are examined. The course investigates how lakes are formed and how they evolve over time. The shape of the lake basin, its water balance, and the catchment area are studied with respect to their influence on the ecology within the lake. Students learn how to assess the health of a lake, how to examine water quality, how to handle aquatic weed problems, and how to manage a lake fishery. A one-day field trip to a lake, pond, or reservoir is required.

APPROVED:

Digitally signed by Jason Janke
DN: cn=Jason Janke, o, ou, email=jjanke1@musc.edu, c=US
Date: 2012.11.07 13:22:18 -07'00'

*If crosslisted, attach completed Course Crosslisting Agreement Form
Required Reading and Other Materials will be equivalent to:

8 additional journal articles pertaining to topics covered. New articles selected each year to stay up to date.

Specific, Measurable Student Behavioral Learning Objectives:
Upon completion of this course the student should be able to
1. Explain how lakes and reservoirs act as a system;
2. Describe the physical characteristics of a lake such as lake morphometry and water renewal time;
3. Analyze the water chemistry of a lake and how it influences the system;
4. Identify lake plankton, macrophytes, aquatic plants, insects, and fish.
5. Evaluate the biological community of a lake by indentifying trophic levels present and the species occupying them;
6. Describe species interactions within a lake with respect to predator-prey dynamics and competition among fish;
7. Describe how humans affect lake chemistry and ecology;
8. Conduct a sampling study of a lake by analyzing and summarizing lake morphometry and water quality data;
9. Investigate an independent case study of a lake to determine health of lake; and
10. Utilize field equipment to measure lake chemistry and assess fish populations.

Detailed Outline of Course Content (Major Topics and Subtopics) or Outline of Field Experience/Internship (experience, responsibilities and supervision)

I. The development of Limnology as a field
   A. History
   B. Limitations

II. Water as a unique substance
    A. Characteristics of water
    B. Effects on inhabitants of lakes

III. Hydrologic Cycle
    A. Climate & precipitation and their influence on lakes
    B. Water inputs and outputs
    C. Human Influence on Hydrologic cycle: effect of dams & irrigation

IV. Physical lake characteristics
    A. Origin and Age of Lakes
       1. Glacial lakes
       2. Tectonic lakes
       3. Riverine lakes
       4. Manmade lakes
    B. Global distribution of lakes
       1. Influence of climate
       2. Latitudinal variation
C. Lake morphometry
1. Measuring lake surface area
2. Measuring lake depth
3. Measuring shoreline length
   a. Calculating: lake volume, average depth, and shoreline development factor with measured variables
4. Using lake’s physical shape to predict biological community in lake
5. Water movements within a lake
   a. Surface waves
   b. Internal waves
   c. How the motion of water in a lake influences distribution of dissolved gases

V. Light & temperature influences on lake
   A. Light attenuation
   B. Light & photosynthesis
   C. Lake stratification

VI. Water chemistry
   A. Terrestrial landscape effect on lakes
      1. Salinity & Ion composition
      2. Sedimentation
   B. Nitrates
      1. Nitrification
      2. Denitrification
      3. Nitrogen Fixation
   C. Phosphates
      1. Phosphorous and Phytoplankton production
      2. Sources of phosphorous in system
      3. Eutrophication
   D. Carbon cycle within lake
      1. Carbon Dioxide in water
      3. Alkalinity
   E. Dissolved Oxygen
      1. How dissolved oxygen limits biological community

VII. Biological Community
   A. Bacteria
   B. Zooplankton
   C. Aquatic plants

VIII. Lake fish species

IX. Acidification of Lakes
   A. Sources of Acid precipitation
   B. Acid-Sensitive waters

Evaluation of Student Performance
1. At least two exams
2. Case study paper
3. Field sampling report
REGULAR COURSE SYLLABUS

School of: Letters, Arts, and Sciences
Department: Earth and Atmospheric Sciences
Prefix & Course Number: ENV 4450
Crosslisted With*: ___
Course Title: Stream Ecology
Check All That Apply: Required for Major: X Required for Minor: ___ Specified Elective: X
Required for Concentration: X Elective: X Service Course: ___
Credit Hours: 3 (2+2)
Total Contact Hours per semester (assuming 15-16 week semester):
   Lecture 30 Lab 30 Internship ___ Practicum ___ Other (please specify type and hours): ___
Schedule Type(s): L Grading Mode(s): ___
Variable Topics Courses (list restrictions, including the maximum number of hours that can be earned**):
   ___
** NOTE: This information must be included in the course description.
Restrictions (Variable Topics Course): ___
Prerequisite(s): ENV 1200; BIO 1081; and BIO 1091; or permission of the instructor
Corequisite(s): None
Prerequisite(s) or Corequisite(s):
Banner Enforced:
   Prerequisite(s): ENV 1200; BIO 1081; and BIO 1091
   Corequisite(s): None
   Prerequisite(s) or Corequisite(s): None
Catalog Course Description:
This course explores the diversity of running water ecosystems throughout the world by examining the chemistry,
physical features, and biology of stream ecosystems. Principles of stream ecology will be used to examine local
stream ecosystems ranging from those found in the mountains to the prairies. The relationship among a stream, its
watershed, floodplain, and riparian zone will be studied. Human activities that alter water quality, chemistry, and
the ecology of a stream will be investigated as well as methods to mitigate and protect lotic (flowing water)
ecosystems. Students will have an opportunity to apply what they have learned in the classroom during a one-day
mandatory field trip.

APPROVED:

Digital signed by Jason Janke
DN: cn=Jason Janke, o, ou, email=jjanke1@mscd.edu, c=US
Date: 2012.11.07 13:23:00 -07'00'

Department Chair OR Program Director

Dean OR Associate Dean

Associate VP, Academic Affairs

*If crosslisted, attach completed Course Crosslisting Agreement Form
Required Reading and Other Materials will be equivalent to:

Text:

Specific, Measurable Student Behavioral Learning Objectives:
Upon completion of this course, the student should be able to:
1. Understand the temporal patterns of river flow and their influence on river ecosystems;
2. Describe how humans alter water flowpaths and river flow;
3. Analyze the relationship between a river and its landscape in terms of geomorphologic and environmental variables;
4. Understand streamwater chemistry by assessing the relationship among items such as dissolved ions, nutrients, dissolved organic matter, gases, and trace metals;
5. Determine how the physical, abiotic environment of a stream influences the distribution of organisms;
6. Explain the ecology of a stream by identifying primary and secondary producers and the detritus material pathways and detritivores in streams;
7. Evaluate the effectiveness of models used in stream ecology;
8. Demonstrate the ability to detect pollutants in streams and assess their source of input.

Detailed Outline of Course Content or Outline of Field Experience/Internship (experience, responsibilities and supervision)

I. Overview of Fluvial Ecosystems
   A. Fluvial hierarchy
   B. Longitudinal patterns
   C. Energy sources in rivers

II. Streamflow
   A. The water cycle
      1. Global water cycle
      2. Water balance of a catchment
      3. Surface versus groundwater pathways
   B. Streamflow; the hydrograph
   C. Flow variation
      1. Effect of land use on streamflow

III. Fluvial Geomorphology
   A. The stream channel
      1. Sinuosity
      2. Pool-riffle features
      3. The floodplain
   B. Sediments and their transport
   C. The River Continuum concept
      1. Channel classifications and their uses
IV. Streamwater Chemistry
   A. Dissolved Gases
   B. Major ions
   C. The bicarbonate buffer system
   D. Influence of chemical factors on the biota
      1. Salinization
      2. Effects of acidity

V. The Abiotic Environment
   A. Flow
      1. Quantification of flow conditions
      2. Influence of flow on the biota
   B. Substrate
      1. Inorganic substrates
      2. Organic substrates
   C. Temperature
      1. Influence of thermal regime on biota

VI. Primary Producers
   A. Benthic Algae
      1. Species
      2. Temporal & spatial variation in benthic algae
   B. Macrophytes
      1. Species
      2. Limiting factors for macrophytes
   C. Phytoplankton
      1. Species
      2. Limiting factors for phytoplankton

VII. Detrital Energy Sources
   A. The decomposition of Coarse Particulate Organic Matter (CPOM)
      1. Stages in the breakdown and decay of CPOM
      2. The influence of detritivores on decay of CPOM
   B. Fine Particulate Organic Matter
   C. Dissolved Organic Matter (DOM)
      1. Uptake of DOM

VIII. Trophic Relationships
   A. Microbial food webs
   B. Invertebrate feeding roles
      1. Herbivory
      2. Predaceous invertebrates
   C. Vertebrates in lotic systems
      1. Fishes
   D. Secondary Production
IX. Species Interactions
   A. Herbivory
      1. Species of herbivorous macroinvertebrates
      2. Grazers response to food supply and effects on periphyton
      3. Top-down and bottom-up effects on periphyton
   B. Predation
      1. Species of vertebrate predators
      2. Species of invertebrate predators
      3. Predator prey interaction
      4. Prey defenses
      5. Effects of predation on prey population
      6. Trophic cascades
   C. Competition
      1. Resource partitioning
      2. Experimental studies of competition

X. Lotic Communities
   A. Regional patterns of species diversity
      1. Species-area relationships
      2. Local diversity
   B. Community structure
      1. Disturbance- species-level effects of disturbance & system-wide effects
   C. Food webs

XI. Nutrient Dynamics
   A. Nitrogen Cycling
   B. Phosphorus Cycling
   C. Transport
   D. Factors influencing nutrient dynamics
   E. Nutrient budgets
   F. Mitigating eutrophication

XII. Stream Metabolism
   A. Autochthonous Production
   B. Allochthonous Inputs
   C. Processes
   D. Stream ecosystem metabolism

XIII. Human Impacts
   A. Impaired species
   B. Threats to rivers
      1. Habitat alteration
      2. Nonindigenous species
      3. Pollution
      4. Overexploitation
      5. Climate change
C. River Management
   1. Restoration
   2. Protected areas

Evaluation of Student Performance
   1. At least two exams
   2. Case study paper
   3. Field sampling report
   4. Class participation in discussions
REGULAR COURSE SYLLABUS

School of:  Letters, Arts, and Sciences

Department:  Earth and Atmospheric Sciences

Prefix & Course Number:  ENV 4460  Crosslisted With*:  

Course Title:  Advanced Water Quality Analysis

Check All That Apply:  Required for Major: X  Required for Minor:  Specified Elective:  
Required for Concentration: X  Elective: X  Service Course:  

Credit Hours:  3 (1+4)

Total Contact Hours per semester (assuming 15-16 week semester):
Lecture 15  Lab 60  Internship  Practicum  Other (please specify type and hours):  

Schedule Type(s):  R  Grading Mode(s):  L

Variable Topics Courses (list restrictions, including the maximum number of hours that can be earned**):

** NOTE: This information must be included in the course description.

Restrictions (Variable Topics Course):  

Prerequisite(s):  CHE 1800, CHE 1810, CHE 1850; ENV 2100

Corequisite(s):  None

Prerequisite(s) or Corequisite(s):  None

Banner Enforced:

Prerequisite(s):  CHE 1800, CHE 1810, CHE 1850; ENV 2100
Corequisite(s):  None
Prerequisite(s) or Corequisite(s):  None

Catalog Course Description:

This course examines advanced methods and protocols used in surface water, ground water, wetland, and terrestrial environmental sampling. Field methods for data collection as well as operation of standard sampling equipment and instruments are explored. Students design and conduct statistically valid sampling plans and conduct standard laboratory procedures for analysis of field data. Guidance documents and sampling techniques used by environmental agencies are addressed.

APPROVED:

Digitally signed by Jason Janke
DN: cn=Jason Janke, o, ou, email=jjanke1@mscd.edu, c=US
Date: 2012.11.07 13:23:30 -07'00'

*If crosslisted, attach completed Course Crosslisting Agreement Form
Required Reading and Other Materials will be equivalent to:


Specific, Measurable Student Behavioral Learning Objectives:
Upon completion of this course the student will be able to

1. Interpret current State and Federal water quality standards and water sampling protocols.
2. Effectively communicate with water quality professionals using technical presentations and report writing.
3. Identify appropriate sampling and analytical methods for the identification and quantification of various water components.
4. Prepare calibration standards and calibrate various analytical instruments to obtain optimal results.
5. Analyze water samples with a high degree of accuracy and precision.

Detailed Outline of Course Content (Major Topics and Subtopics) or Outline of Field Experience/Internship (experience, responsibilities and supervision)

I. Drinking Water Regulations in the United States

II. Water Sampling Protocols
   i. Quality control/Quality Assurance
   ii. Accuracy and precision
   iii. Sample Preservation and handling
   iv. Laboratory Activity: Water sampling Techniques-Field Class

III. Physical Characterization of Water
   i. Laboratory Activity: Specific Conductance, residues

IV. Acidity and pH Measurements
   i. Laboratory Activity: pH measurement of field samples and collected samples.

V. Alkalinity and Buffering Capacity
   i. Laboratory Activity: Alkalinity Determination

VI. Spectrophotometry – Beer and Lambert Law
   i. Laboratory Activity: Orthophosphate Determination

VII. Dissolved Oxygen
   i. Laboratory Activity: DO determination (Winkler Titration); Field Measurement

VIII. Determination of Organic Carbon
   i. Laboratory Activity: BOD₅ determination

IX. Calcium Hardness
   i. Chelation
   ii. Laboratory Activity: Selective complexation of metals
X. Total Hardness
   i. Laboratory Activity: Total, Calcium, & Magnesium Hardness by EDTA

XI. Instrumental Analysis of Metals
   i. Atomic Absorption Spectrophotometry (AAS)
   ii. Inductively Coupled Plasma (ICP)
   iii. Laboratory Activity: Hardness determination using ICP.

XII. Anion Analysis Techniques
   i. specific ion electrodes
   ii. colorimetric analysis
   iii. Ion chromatography (IC)
   iv. Laboratory Activity: Sulfate analysis using IC

XIII. Estimation of Eutrophication
   i. Laboratory Activity: Chl a determination and estimate of biomass

XIV. Chlorination
   i. Laboratory Activity: Chemical Characterization of unknown water sample

XV. Heavy Metals
   i. Laboratory Activity: Chemical Characterization of unknown water sample

Evaluation of Student Performance

1. Examinations
2. Quizzes
3. Laboratory reports
4. Research paper
5. Class presentation
REGULAR COURSE SYLLABUS

School of: Letters, Arts, and Sciences

Department: Earth and Atmospheric Sciences

CIP Code: 03.0104

Prefix & Course Number: ENV 4500  Crosslisted With*: ______

Course Title: Environmental Biogeochemistry

Check All That Apply: Required for Major: X  Required for Minor: _____  Specified Elective: X

Required for Concentration: _____  Elective: X  Service Course: _____

Credit Hours: 3 (3 + 0)

Total Contact Hours per semester (assuming 15-16 week semester):

Lecture 45  Lab _____  Internship _____  Practicum _____  Other (please specify type and hours):_____

Schedule Type(s): Lecture  Grading Mode(s): L

Variable Topics Courses: N/A

** NOTE: This information must be included in the course description.

Restrictions (Variable Topics Course): N/A

Prerequisite(s): ENV 1200, BIO 1091, CHE 1850, and at least junior standing; or permission of instructor

Corequisite(s): None

Prerequisite(s) or Corequisite(s): None

Banner Enforced: N/A

Corequisite(s): None

Prerequisite(s) or Corequisite(s): None

Catalog Course Description:

This course examines the chemical processes and pathways by which inorganic and organic chemical species interact within aquatic and terrestrial ecosystems. Environmental factors that control the chemical composition and bioavailability will be emphasized for both natural and human impacted (polluted) systems.

APPROVED:

Department Chair OR Program Director  

Dean OR Associate Dean  

Associate VP, Academic Affairs
ENV 4500 Environmental Biogeochemistry

Required Reading and Other Materials will be equivalent to:


Additional readings from journal articles will be required.

Specific, Measurable Student Behavioral Learning Objectives:

Upon successful completion of this course, students will be able to:
1. Determine the physical and chemical factors controlling the composition of natural waters.
2. Identify and quantify predominate chemical species using various chemical speciation techniques.
3. Interpret and explain complex ion formation and equilibrium.
4. Determine solid phase formation using field data and geochemical modeling techniques.
5. Assess the role of dissolved organic matter in altering chemical equilibrium in natural waters
6. Predict the behavior of herbicide and organic contaminants in sediment and pore water.
7. Utilize various adsorption models to explain the fate of chemical species in natural waters.
8. Critically examine the validity of environmental water data.

Detailed Outline of Course Content:

I. Course Introduction.
   A. Thermodynamic principles.
   B. Aqueous complexes.

II. General controls on natural water chemistry
   A. Controls on the chemical composition of rivers.
   B. General chemistry of surface ground waters.
   C. Soil-moisture chemistry

III. Activity coefficients/complex ion formation
   A. Activities coefficients of ions
   B. Overview of activity coefficient models
   C. Activity coefficients of molecular species.

IV. Gases in water and aqueous equilibrium
   A. Carbonate chemistry
   B. Influences on the solubility and saturation state of carbonate minerals

V. Acids and bases/alkalinity
   A. Carbon dioxide and carbonic acid species in natural waters
   B. Sources of acidity and alkalinity in natural waters.

VI. Dissolved organic carbon
   A. Humic and fulvic acids
   B. Complexation of metals with dissolved organic carbon

VII. Solid phase equilibrium
   A. Mineral stability diagrams.
   B. Solubility of aluminosilicates
   C. Uncertainty in mineral stability diagrams.

VIII. Adsorption Models/partition coefficients
   A. Sorption isotherms and Distribution coefficients.
   B. Ion-exchange type models and concepts
   C. Electrostatic models and concepts
XII. Biogeochemical cycles
   A. phosphorus
   B. nitrogen
   C. carbon

XIII. Chemistry of Pit lakes
   A. physical chemical limnology of pit lakes
   B. chemical speciation and equilibria

XIV. REDOX processes/sediment water
   A. Redox theory and measurement
   B. Redox behavior of natural water systems

XV. Geochemistry of water/clay mineral interfaces
   A. Crystal chemistry of important clay minerals
   B. Sources of surface charge

XVI. Double layer theory
   A. Distribution of ions near charged surfaces
   B. Affect on colloidal properties

XVII. Vadose zone/pore water chemistry
   A. Behavior of pesticides in soil water
   B. Biodegradation of dissolved organic compounds

XVIII. Water pollution/stream chemistry
   A. Stream water modeling dissolved oxygen
   B. Factors controlling dissolved oxygen in natural waters.

Evaluation of Student Performance:

1. Examinations
2. Reports and projects
3. Problem Sets
4. Case Studies Discussions
5. Class attendance and participation
REGULAR COURSE SYLLABUS

School of: Letters, Arts, and Sciences
Department: Earth and Atmospheric Sciences
CIP Code: 03.0104
Prefix & Course Number: ENV 4910 Crosslisted With*: None
Course Title: Global Environmental Field Problems: Variable Topics
Check All That Apply: Required for Major: ___ Required for Minor: ___ Specified Elective: X
Required for Concentration: X Elective: X Service Course: ___
Credit Hours: 3 (1+4)
Total Contact Hours per semester (assuming 15-16 week semester):
Lecture 15 Lab 120 Internship ___ Practicum ___ Other (please specify type and hours): ___
Schedule Type(s):  Lecture Grading Mode(s): L
Variable Topics Courses (list restrictions, including the maximum number of hours that can be earned**):
** NOTE: This information must be included in the course description.
Restrictions (Variable Topics Course): 9
Prerequisite(s): ENV 1200, 9 hours in any combination of Environmental Science, Geology, Physical Geography, Biology, Chemistry, and Meteorology courses, and at least junior standing; or permission of instructor
Corequisite(s): None
Prerequisite(s) or Corequisite(s): None
Banner Enforced:
Prerequisite(s): None
Corequisite(s): None
Prerequisite(s) or Corequisite(s): None
Catalog Course Description:
Students will use field techniques to research and analyze global environmental problems. Possible field experiences will examine environmental or ecological change by traveling to the Sangre de Cristo Mountains of Colorado, the Sonoran desert in Arizona, or alpine and periglacial regions of Alaska. This course may be repeated three times for credit under different topics for a maximum of nine hours.

APPROVED:

Date
12/01/08
Department Chair OR Program Director

Date
12-2-08
Dean OR Associate Dean

Date
12/18/08
Associate VP, Academic Affairs
ENV 4980: Global Environmental Field Problems: Variable Topics

Required Reading and Other Materials will be equivalent to:

A list of necessary reading materials will be provided by the instructor. Readings will vary according to the course topics being presented.

Specific, Measurable Student Behavioral Learning Objectives:

Upon completion of this course, students will be able to:
1. Judge the importance of global environmental problems.
3. Propose a scientifically sound research question or problem.
4. Design a research proposal.
5. Compare the scientific methods for obtaining data.
6. Collect and analyze scientific data to support or challenge their research findings.
7. Organize a scientific paper.

Detailed Outline of Course Content:

Course content will vary according to the topic identified. The course will follow this general procedure:

I. Lecture portion of the class
   A. Introduction to environmental problem
      1. Geology
      2. Ecology
      3. Human Impacts/Environmental Challenges
   B. Camping and Hiking Safety
   C. Designing a research question
      1. Conducting a Literature Review
      2. Other Sources
   D. Writing a Scientific Paper
      1. Introduction
      2. Study Area
      3. Literature Review
      4. Methods
      5. Results
      6. Discussion
      7. Conclusions
   E. Student Presentations: Project Proposals

II. Field portion of the class
   A. Travel to field site/get acclimated
   B. Local environmental characteristics
   C. Select a field Site
   D. Conduct Projects
   E. Return to campus
   F. Complete Final Papers

Evaluation of Student Performance:

1. 15-20 Page Research Paper or Proposal
2. Student presentations
3. Other assignments as required by the instructor
REGULAR COURSE SYLLABUS

School of: Letters, Arts, and Sciences
Department: Earth and Atmospheric Sciences
Prefix & Course Number: ENV 491D    Crosslisted With*: None

Course Title: Global Environmental Field Problems: The Mountains, Valleys, and Coasts of Chile
Check All That Apply: Required for Major: ____  Required for Minor: ____  Specified Elective: X
Required for Concentration: X  Elective: X  Service Course: ____

Credit Hours: 3 (1+4)

Total Contact Hours per semester (assuming 15-16 week semester):
Lecture 15  Lab 120  Internship ____  Practicum ____  Other (please specify type and hours): ____

Schedule Type(s): L  Grading Mode(s): L

Variable Topics Courses (list restrictions, including the maximum number of hours that can be earned**):

** NOTE: This information must be included in the course description.

Restrictions (Variable Topics Course): 9

Prerequisite(s): ENV 120C, 9 hours in any combination of Environmental Science, Geology, Physical Geography, Biology, Chemistry, and Meteorology courses, and at least junior standing, or permission of instructor
Corequisite(s): None

Prerequisite(s) or Corequisite(s): None

Banner Enforced:

Prerequisite(s): None
Corequisite(s): None
Prerequisite(s) or Corequisite(s): None

Catalog Course Description:
Students will use field techniques to research and analyze global environmental problems. Possible field experiences will examine environmental or ecological change by traveling to the Sangre de Cristo Mountains of Colorado, the Sonoran desert in Arizona, or alpine and periglacial regions of Alaska. This course may be repeated three times for credit under different topics for a maximum of nine hours.

APPROVED:

Department Chair OR Program Director  Date

Dean OR Associate Dean  Date

Associate VP, Academic Affairs  Date

*If crosslisted, attach completed Course Crosslisting Agreement Form
Prefix and Course Number: ENV 4910D

Required Reading and Other Materials will be equivalent to:
An electronic dossier will be made available to students with all the academic readings.

Specific, Measurable Student Behavioral Learning Objectives:

Upon completion of this course, students will be able to:

1. Broaden the geographical knowledge of the participants on the current culture and society of Southern Cone Countries.
2. Facilitate environmental research on Chile’s diverse geography and unique ecology.
3. Facilitate an understanding of Chile’s current development model.
4. Facilitate an on-site study of the dynamics between a growing economy and the associated environmental issues.
5. Provide the tools to comprehend Chile’s environmental framework: institutions, policies, and science.
6. Enrich the understanding of sustainable practices and mitigation/adaptation efforts to climate change.
7. Explore the current evolution of glaciers in the Andes and the associated impact on water availability.
8. Study Chilean political ecology dealing with hydrological energy projects and the Aboriginal viewpoints.
9. Provide an opportunity to learn about the current planning and implementation of the large-scale rebuilding effort due to the devastating effects of the Mega Earthquake of February 27th, 2010.

Detailed Outline of Course Content:

The course is designed to integrate on-site lectures with field experiences. The on-site lectures will cover the following topics:

I. Chile’s Urban Development and Planning Framework
II. Chile’s Climates and the Impact of Climate Change
III. The Andean Glaciers and Water Resources
IV. Earthquakes and Volcanism
V. The Political Economy of Development in Chile
VI. Chile’s 20th Century History
VII. Chile’s Political System and Government
VIII. Chilean Natives and the State
IX. Chile’s Environmental Problems and Policy
X. Chile’s Agricultural Export Model: Fruits and Wine for the Global Economy
XI. Coastal Environmental Issues
XII. Environmental Education
XIII. UNESCO World Heritage Sites: Valparaiso
XIV. Chile’s Maritime Environments
XV. Chile’s Unique Biogeography: The Temperate Rain Forest

Co-curricular Field Experiences
Please note some of these excursions are subject to change due to weather conditions:

I. Santiago City Tour
II. The Agricultural Heartland: From Traditional Haciendas to Global Agribusiness
III. The Aconcagua Valley
IV. Department of Geophysics, University of Chile
V. City and University of Valparaiso
VI. Tour to Chile’s Central Coast
VII. City of Viña del Mar
VIII. The Casablanca and Curacavi Valleys
IX. National Park: Lago Peñuelas
Evaluation of Student Performance:

1. 7-10 Page Research Paper
2. Student Presentations
3. Class attendance and Participation
REGULAR COURSE SYLLABUS

School of: Letters, Arts, and Sciences

Department: Earth and Atmospheric Sciences

Prefix & Course Number: ENV 4910 Crosslisted With*: None

Course Title: Global Environmental Field Problems: Applied Geology & Mining History of Germany

Check All That Apply: Required for Major:_____ Required for Minor:_____ Specified Elective: X

Required for Concentration: X  Elective: X  Service Course:_____

Credit Hours: 3 (1+4)

Total Contact Hours per semester (assuming 15-16 week semester):

Lecture 15  Lab 120  Internship _____ Practicum _____ Other (please specify type and hours):_____

Schedule Type(s): L Grading Mode(s): L

Variable Topics Courses (list restrictions, including the maximum number of hours that can be earned**):

** NOTE: This information must be included in the course description.

Restrictions (Variable Topics Course): 2

Prerequisite(s): ENV 120C, 9 hours in any combination of Environmental Science, Geology, Physical Geography, Biology, Chemistry, and Meteorology courses, and at least junior standing; or permission of instructor

Corequisite(s): None

Prerequisite(s) or Corequisite(s): None

Banner Enforced:

Prerequisite(s): None

Corequisite(s): None

Prerequisite(s) or Corequisite(s): None

Catalog Course Description:
Students will use field techniques to research and analyze global environmental problems. Possible field experiences will examine environmental or ecological change by traveling to the Sangre de Cristo Mountains of Colorado, the Sonoran desert in Arizona, or alpine and periglacial regions of Alaska. This course may be repeated three times for credit under different topics for a maximum of nine hours.

APPROVED:

[Signatures and dates]

Department Chair OR Program Director

Dean OR Associate Dean

Associate VP, Academic Affairs
Prefix and Course Number: ENV 4910D

Required Reading and Other Materials will be equivalent to:
An electronic dossier will be made available to students with all the academic readings.

Specific, Measurable Student Behavioral Learning Objectives:

Upon completion of this course, students will be able to:
1. Describe unknown rock formation and assess their geologic history
2. Apply geographical knowledge to current culture and societal issues of Germany with focus on environmental systems.
3. Facilitate environmental research on Germany’s applied geologic technologies and historic geology.
4. Facilitate an on-site study of the dynamics between geology and environmental impact & solutions.
5. Discuss the concept of mining history and development in Germany.
6. Understand higher education and degree programs dealing with environmental science and related fields in the German / European System.
7. Ascertain geology and cultural / historic developments.
8. Understand the hydrogeologic settings and their environmental impact.
9. Understand the cultural impact of environmental policies on the German society.

Detailed Outline of Course Content:

The course is designed to integrate on-site lectures with field experiences. The on-site lectures will cover the following topics:

1. Mines and Mining History
2. Germany’s Natural Resources through the ages
3. Stratigraphy and Rock Formations of Southern Germany
4. Historical geologic overview of Southern Germany
5. Structural Events of Southern Germany, the Molasses Basin and Basic formation of the Alps
6. Germany’s environmental policies: From Trash to Cars
7. Environmental University Degrees and course of study in Germany
8. A hydrologic and hydrogeologic of Southern Germany
9. Solving geologic puzzles within an over-vegetated and urban system: The Nördlinger Ries Impact Crater
10. Famous fossils: Understanding Paleoecologies
11. Geologic Investigations in areas of overgrowth
12. Environmental superfund sites: The Soviet occupational era of eastern Germany: Uranium

Co-curricular Field Experiences

Please note some of these excursions are subject to change due to weather conditions:

1. Mining Tour: Historic Gem Mine, Idar-Oberstein, Germany
2. Mining Tour: Historic Salt Mine, Berchtesgaden, Germany
3. Mining Tour: Historic Precious Metal Mining, Freiberg, Germany
4. Department of Environmental Science, Bayreuth, Germany
5. Department of Geology & Geography, Freiberg, Germany
6. Continental Deep Drilling Project, Windischeschenbach, Germany
7. Fossil Museum & Quarry, Holzmaden, Germany
8. Fossil Museum and Quarry, Solnhofen & Eichstadt, Germany
9. Ries Crater Museum and City Tour, Nördlingen, Germany
10. Many, many other geologic field stops and experience lead by instructor

Evaluation of Student Performance:

Attendance/ Participation at all scheduled sessions 15%
Oral Field Examination by Instructor 20%
Written project - Field Journal Publication 20%
Research Project with Hands-On Application 25%
REGULAR COURSE SYLLABUS

School of: Letters, Arts, and Sciences
Department: Earth and Atmospheric Sciences
CIP Code: 03.0104

Prefix & Course Number: ENV 4920 Crosslisted With*: None

Course Title: Topics in Environmental Science: Variable Topics
Check All That Apply: Required for Major: Required for Minor: Specified Elective: X
Required for Concentration: Elective: X Service Course: 

Credit Hours: 3 (3 + 0)

Total Contact Hours per semester (assuming 15-16 week semester):
  Lecture 45 Lab ______ Internship ______ Practicum ______ Other (please specify type and hours): ______

Schedule Type(s): L Grading Mode(s): L

Variable Topics Courses (list restrictions, including the maximum number of hours that can be earned**):
** NOTE: This information must be included in the course description.

Restrictions (Variable Topics Course): 6
Prerequisite(s): ENV 1200, 9 hours in any combination of Environmental Science, Geology, Physical Geography, Biology, Chemistry, and Meteorology courses, and at least junior standing; or permission of instructor
Corequisite(s): None
Prerequisite(s) or Corequisite(s): None

Banner Enforced:
  Prerequisite(s): ENV 1200 Corequisite(s): None
  Prerequisite(s) or Corequisite(s): None

Catalog Course Description:
Content of this course will vary according to contemporary environmental issues. This course may be repeated twice under different topics for a maximum of 6 hours.

APPROVED: 

Department Chair OR Program Director Date
Dean OR Associate Dean Date
Associate VP, Academic Affairs Date
ENV 4990: Topics in Environmental Science: Variable Topics

Required Reading and Other Materials will be equivalent to:

Instructor will assign pertinent readings applying to the topic at hand.

Specific, Measurable Student Behavioral Learning Objectives:

Upon completion of this course the student should be able to:

1. Evaluate the parameters and dimensions of the topic.
2. Examine the characteristics of the subject.
3. Examine relationships and assess implications of the topic.
4. Apply appropriate methodologies to the topic.
5. Discuss facts relating to the topic.
6. Compare the issues raised by various studies.
7. Assess the alternatives that respond to the issues.

Detailed Outline of Course Content:

The course content will vary with the selection of various environmental topics. Examples of topics to be considered might include Environmental Health and Toxicology, Colorado Water Issues, Global Climate Change, Impacts of Front Range Growth, alternative energy sources on the Auraria Campus, EPA Superfund sites in Colorado, or Effects of Mining on mountain environments.

Students will address the issues of each topic by conducting in depth research. Students will then design a potential plan of action to help remedy or resolve the environmental problem at hand. This report can then be presented to the proper authority to influence legislation.

Evaluation of Student Performance:

1. Examinations
2. Technical Reports
3. Group Projects
4. Term Papers (dependent upon course topic)
5. Student Presentations
REGULAR COURSE SYLLABUS
VARIABLE TOPIC COURSE

School of: Letters, Arts, and Sciences

Department: Earth and Atmospheric Sciences

Prefix & Course Number: ENV 492A Crosslisted With*: ____

Course Title: Topics in Environmental Science: Snow Hydrology

Check All That Apply: Required for Major: ____ Required for Minor: ____ Specified Elective: X

Required for Concentration: ____ Elective: X Service Course: _____

Credit Hours: 3 (3+0)

Total Contact Hours per semester (assuming 15-16 week semester):

Lecture 40 Lab ____ Internship ____ Practicum ____ Other (please specify type and hours): 5
(potential field trip(s))

Schedule Type(s): L Grading Mode(s): L

Variable Topics Courses (list restrictions, including the maximum number of hours that can be earned**): 6

** NOTE: This information must be included in the course description.

Restrictions (Variable Topics Course): Content of this course will vary according to contemporary environmental issues. This course may be repeated twice under different topics for a maximum of 6 hours.

Prerequisite(s): ENV 1200, 9 credit hours in the following Environmental Science, Geology, Physical Geography, Biology, Chemistry, and Meteorology, and junior standing; or permission of instructor

Corequisite(s): None

Prerequisite(s) or Corequisite(s): None

Banner Enforced:

Prerequisite(s): None

Corequisite(s): None

Prerequisite(s) or Corequisite(s): None

Catalog (Umbrella) Course Description:

Content of this course will vary according to contemporary environmental issues. This course may be repeated twice under different topics for a maximum of 6 hours.

APPROVED:

Department Chair OR Program Director

Date

Dean OR Associate Dean

Date

Associate VP, Academic Affairs

Date

*If crosslisted, attach completed Course Crosslisting Agreement Form
Variable Topic Course Description:

This course will focus on snow processes and their function as part of the hydrologic cycle. The course will cover snow formation in the atmosphere, snow accumulation and measurement, and distribution, snowpack metamorphism and basic energy exchange principles, snow chemistry, snow ablation and runoff/watershed processes, and snow management issues. Course content will be amplified through case studies and/or field trip(s).

Required Reading and Other Materials will be equivalent to:


Specific, Measurable Student Behavioral Learning Objectives:

Upon completion of this course the student should be able to:
1. Understand the basic processes of snow formation, accumulation, and distribution.
2. Analyze the influence of snow on various components of the hydrologic cycle.
3. Relate ablation/snowmelt processes and their influence with regard to watershed management.
4. Relate issues related to snow chemistry and water quality.
5. Understand the physical changes of a snowpack over time.
6. Relate basic snowpack dynamics to watershed processes.
7. Use critical thinking to analyze various issues related to snow and its management through interpretation of case studies.

Detailed Outline of Course Content (Major Topics and Subtopics) or Outline of Field Experience/Internship (experience, responsibilities and supervision) (format: I, A, 1, a, etc.):

Course content will include:
1. Introduction to snow
2. Snow formation and precipitation processes.
3. Accumulation and snow cover distribution.
4. Snow measurement.
5. Snowpack metamorphosis and basic energy exchange principles.
7. Ablation and runoff processes.
8. Snow management:
   a. Avalanche management
   b. Skiing and management of snow
   c. Snow redistribution
9. Legal issues of ownership, redistribution, and weather modification.
10. Basic information related to modeling of snowpack, and related water supply.

Evaluation of Student Performance (format: 1, a, i, ii, etc.):

APPROVED:

<table>
<thead>
<tr>
<th>Department Chair OR Program Director</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dean OR Associate Dean</td>
<td>Date</td>
</tr>
<tr>
<td>Associate VP, Academic Affairs</td>
<td>Date</td>
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</tbody>
</table>

*If crosslisted, attach completed Course Crosslisting Agreement Form*
Students will be evaluated through:

1. Three in class exams
2. A comprehensive final exam
3. Homework to evaluate the student’s understanding of the material covered in class and to provide opportunities for critical thinking relative to issues with snow management.
4. A final project in the form of a paper or presentation to evaluate the student’s critical thinking with regard to a selected specific snow management project or issue.
METROPOLITAN STATE UNIVERSITY OF DENVER
Office of Academic and Student Affairs

REGULAR COURSE SYLLABUS
VARIABLE TOPIC COURSE

School of: Letters, Arts and Sciences

Department: Earth and Atmospheric Sciences

Prefix & Course Number: ENV 492

Course Title: Water Auditing and Analysis

Crosslisted With*:

Check All That Apply: Required for Major: _____ Required for Minor: _____ Specified Elective: _____
Required for Concentration: _____ Elective: X Service Course: _____

Credit Hours: 3 (2+2)

Total Contact Hours per semester (assuming 15-16 week semester):
Lecture 30 Lab 30 Internship _____ Practicum _____ Other (please specify type and hours): _____

Schedule Type(s): L Grading Mode(s): L

Variable Topics Courses (list restrictions, including the maximum number of hours that can be earned**):

** NOTE: This information must be included in the course description.

Restrictions (Variable Topics Course):

Prerequisite(s): Completion of General Studies Requirements

Corequisite(s): none

Prerequisite(s) or Corequisite(s): none

Banner Enforced:
Prerequisite(s): none
Corequisite(s): none
Prerequisite(s) or Corequisite(s): none

Catalog (Umbrella) Course Description:

Content of this course will vary according to contemporary environmental issues. This course may be repeated twice under different topics for a maximum of 6 hours.

APPROVED:

Kenneth Englund 10/4/12
Department Chair OR Program Director

Hilma A. Thompson 10/4/12
Dean OR Associate Dean

Associate VP, Academic Affairs

*If crosslisted, attach completed Course Crosslisting Agreement Form
Variable Topic Course Description:

Water auditing and analysis, including the consequences of outdated equipment and other disturbances, is commonly used to indicate efficiency of indoor water usage. This course exposes students to the methods and techniques used in water auditing and analysis. Students will learn how to complete an indoor water audit, analyze their results, and summarize the implications of the results.

Required Reading and Other Materials will be equivalent to:


Specific, Measurable Student Behavioral Learning Objectives:
Upon completion of this course the student should be able to:

1) Understand how to plan for and conduct an indoor water audit
2) Analyze and interpret water audit data
3) Create graphs and figures to display data
4) Design effective reports and presentations using a conservation framework

Detailed Outline of Course Content (Major Topics and Subtopics) or Outline of Field Experience/Internship (experience, responsibilities and supervision):

I. Water Audit Knowledge

A. Pre-Audit Information. Students will:
   a. Read required materials on water audits
   b. Analyze campus water and sewer bills and rate structure for billing
   c. Identify sources of water
      i. Ground, Surface, Municipal, Rainwater, etc.
   d. Identify water benchmarks on campus; what drives water usage
   e. Understand water conservation framework

B. Field Experience
   a. Led by Denver Water’s facility engineer or representative, the conservation technicians and engineers will walk students through several buildings at MSU Denver to identify all water-using fixtures and processes. Students will:
      i. Locate water meters
      ii. Identify areas of greatest water use
      iii. Record measurements
         1. Inventory water use of all equipment, fixtures and leaks in specified buildings
      iv. Replace faucet aerators if needed

C. Water Audit Analysis
   a. Analyze water audit data
   b. Summarize data and check against bills and industry benchmarks
   c. Summarize potential savings if retrofits are made
   d. Document historical water consumption information
   e. Apply a water conservation framework to report
D. Present data and results during a formal in-class presentation

E. Evaluation of Student Performance:

1. Exams
2. Water Auditing Exercises
3. Completion of Data Analysis
4. Summary of Results
5. In-class Presentation
REGULAR COURSE SYLLABUS

School of: Letters, Arts, and Sciences
Department: Earth and Atmospheric Sciences
CIP Code: 03.0104
Prefix & Course Number: ENV 4950
Course Title: Internship in Environmental Science
Crosslisted With*: None

Check All That Apply: Required for Major: ___ Required for Minor: ___ Specified Elective: X
Required for Concentration: ___ Elective: X Service Course: ___
Credit Hours: 2-15 (0 + 6-45)

Total Contact Hours per semester (assuming 15-16 week semester):
Lecture Lab Internship 90-675 Practicum Other (please specify type and hours):

Schedule Type(s): Internship Grading Mode(s): L
Variable Topics Courses (list restrictions, including the maximum number of hours that can be earned**):
N/A

** NOTE: This information must be included in the course description.

Restrictions (Variable Topics Course): N/A

Prerequisite(s): Environmental science major or land use major with concentration in environment and resources, at least junior standing, 12 credit hours in environmental science, and permission of the Chair of the Earth and Atmospheric Sciences Department

Corequisite(s): None

Prerequisite(s) or Corequisite(s): None

Banner Enforced:
Prerequisite(s): None
Corequisite(s): None
Prerequisite(s) or Corequisite(s): None

Catalog Course Description:
This course provides an on-the-job internship experience with an environmental science-related company or agency. The experience must be done under qualified supervision and the auspices of an Earth and Atmospheric Sciences faculty member.

APPROVED:

Department Chair OR Program Director

Dean OR Associate Dean

Associate VP, Academic Affairs

*If crosslisted, attach completed Course Crosslisting Agreement Form
ENV 4950: Internship in Environmental Science

Required Reading and Other Materials will be equivalent to:

Necessary reading materials will be provided by the participating company or agency.

Specific, *Measurable* Student Behavioral Learning Objectives:

This course provides the opportunity students to correlate theoretical knowledge with actual practice, under the guidance of an experienced supervisor. Upon successful completion of this course, the student will be able to:

1. Apply, test, and evaluate, under actual working conditions, knowledge gained in the classroom.
2. Value the importance of practical experience in preparation for employment or career development.
3. Assess the decision-making processes in jobs requiring an environmental science background.
4. Evaluate one’s own capabilities and needs in the workplace.

Detailed Outline of Course Content:

A specific job description and work schedule is developed for each placement and is on file in the Department of Earth and Atmospheric Sciences. A student is expected to work 45 hours for each hour of academic credit granted. On-the-job supervision and training is provided by the company or agency, with overall supervision provided by the Earth and Atmospheric Sciences faculty. The company or agency provides an evaluation of the student’s work, which becomes the basis for the grade.

Evaluation of Student Performance:

Students are evaluated by progress reports and consultation with the supervisor.
REGULAR COURSE SYLLABUS

School of: Letters, Arts and Sciences

Department: Earth and Atmospheric Sciences

CIP Code: 04.0301

Prefix & Course Number: ENV 4960 Crosslisted With*: N/A

Course Title: Global Environmental Challenges

Check All That Apply: Required for Major: X Required for Minor: ____ Specified Elective: X

Required for Concentration: X Elective: X Service Course: ____

Credit Hours: 3 (3 + 0)

Total Contact Hours per semester (assuming 15-16 week semester):

Lecture 45 Lab 0 Internship 0 Practicum 0 Other (please specify type and hours): 0

Schedule Type(s): L Grading Mode(s): L

Variable Topics Courses (list restrictions, including the maximum number of hours that can be earned*): N/A

*NOTE: This information must be included in the course description.

Restrictions (Variable Topics Course): None

Prerequisite(s): Twelve hours of upper-division courses in geology, geography, biology, and/or meteorology, or written permission of instructor, and senior standing.

Corequisite(s): None

Prerequisite(s) or Corequisite(s): None

Banner Enforced:
Prerequisite(s): None
Corequisite(s): None
Prerequisite(s) or Corequisite(s): None

Catalog Course Description: This course will include the identification of major global environmental problems, including causes and impacts and the interplay of economic, cultural, and political forces. The approach will be a geographic analysis including location, spatial distribution, density, boundaries, and physical factors such as landforms, soils, and climate. Students are responsible as individuals and groups for presentations and discussions. (Senior Experience)

APPROVED:

Department Chair OR Program Director

Dean OR Associate Dean

Associate VP, Academic Affairs
Prefix and Course Number: ENV 4960

Required Reading and Other Materials will be equivalent to:


Specific, Measurable Student Behavioral Learning Objectives:

Upon completion of this course the student should be able to:

1. identify and discuss major global environmental issues;
2. translate raw data into charts and graphs and evaluate the results;
3. identify geographic patterns and trends in environmental issues and assess contributing factors;
4. explain relationships between population, resources, and environmental problems;
5. identify trends in public policy and explain current issues as they relate to the environment;
6. analyze relationships between cultural "needs" and economic and political "realities" and environmental problems;
7. demonstrate skills of critical and analytical thinking;
8. evaluate selected critical zones in terms of the impacts of human activity and suggest sustainable solutions;
9. prepare professional quality research documents;
10. lead class discussions;
11. evaluate and apply basic geographic concepts in research and discussions; and
12. role play in simulated environmental scenarios.

Detailed Outline of Course Content (Major Topics and Subtopics or Outline of Field Experience/Internship (experience, responsibilities and supervision)):

I. Introduction
II. Identification and Ranking of Major Global Environmental Issues
III. Overview of the Geography of Global Change
   A. Geoeconomic
   B. Geopolitical
   C. Geosocial
   D. Geocultural
   E. Geoenvironmental
IV. The Human Dimensions of Global Change
   A. Relationship of Human Activity to Global Change
   B. Decision Making Issues
   C. Environmental Impacts of International Trade and Loan Organizations
V. Endangered and Critical Environmental Zones
VI. Issues in Sustainability
VII. Conflicting Land Use Issues in the Rainforest (Simulation)
VIII. Environmental Justice, Environmental Ethics and Eco-Racism
IX. The Aral Sea As A Critical Zone (Simulation)
X. Nature's Limits: The China Factor. Who Will Feed China?
XI. The Nepal Middle Mountains
XII. The Ukambani Region of Kenya
XIII. The Llano Estacado of the American Southern Plains
XIV. The Basin of Mexico
XV. The North Sea
XVI. The Ordos Plateau of China
XVII. The Eastern Sundaland Region of Southeast Asia
XVIII. Comparisons and Conclusions
Evaluation of Student Performance:

1. Class attendance and participation in discussions of major global environmental issues and participation in two simulations
2. 20-page research paper analyzing a major global environmental issue, including evaluation of a critical zone, including possible solutions
3. Oral presentation of research paper--uses visuals and demonstrates analytical skills and the ability to answer questions
4. Critical-zone presentation--presents a discussion of a critical zone from the text, including potential solutions
5. Specific parts of research paper turned in on time and in proper format, including an annotated bibliography
6. Review of one article from a refereed journal
REGULAR COURSE SYLLABUS

School of: Letters, Arts, and Sciences
Department: Earth and Atmospheric Sciences
CIP Code: 03.0104
Prefix & Course Number: ENV 4970  Crosslisted With*: None
Course Title: Environmental Field Studies

Check All That Apply:  Required for Major:  Required for Minor: X  Specified Elective: X
Required for Concentration:  Elective: X  Service Course: 

Credit Hours: 3 (1 + 4)

Total Contact Hours per semester (assuming 15-16 week semester):
Lecture 15  Lab 120  Internship  Practicum  Other (please specify type and hours):

Schedule Type(s): L  Grading Mode(s): L
Variable Topics Courses: N/A
** NOTE: This information must be included in the course description.

Restrictions (Variable Topics Course): N/A
Prerequisite(s): 12 hours of upper-division courses in geology, physical geography, biology, meteorology and/or environmental science or written permission of instructor; completion of all Level I and Level II General Studies course requirements, senior standing
Corequisite(s): None

Prerequisite(s) or Corequisite(s): None

Banner Enforced:
Prerequisite(s): None
Corequisite(s): None
Prerequisite(s) or Corequisite(s): None

Catalog Course Description:
This course is a senior-level capstone course for land use and environmental science majors that will address current local environmental issues in Colorado through site visits and field techniques. Topics covered include Denver air quality, water quality, sustainability, and waste disposal. Field trips will be taken to local environmental sites and agencies (Senior Experience).

APPROVED:

Department Chair or Program Director

Dean or Associate Dean

Associate VP, Academic Affairs
ENV 4970: Environmental Field Studies

Required Reading and Other Materials will be equivalent to:

Necessary reading materials will be provided by the instructor.

Specific, Measurable Student Behavioral Learning Objectives:

Upon completion of this course, students will be able to:
1. Explain the interdisciplinary nature of environmental science.
2. Identify and discuss the scope of environmental issues in the Denver region with students, faculty and environmental professionals.
3. Identify and define a specific environmental topic for further investigation and analysis.
4. Prepare a written field investigation outline that includes the problem to be investigated, hypotheses, methodology, results, timeline, hypothetical budget, and hypothetical staff.
5. Conduct detailed library research.
6. Conduct a specific environmental field investigation utilizing multiple techniques.
7. Analyze the data collected during the field investigation.
8. Compare the results of the data analysis to the original hypothesis and suggest conclusions and/or solutions.
9. Write a field investigation report that includes an investigation outline (introduction, methods, and results), tabulated or graphic display of data, and conclusion.
10. Make a professional oral presentation.
11. Formulate a research proposal based on the scientific literature.

Detailed Outline of Course Content:

I. Introduction
II. Designing a research question
   A. Conducting a Literature Review
   B. Other Sources
III. Writing a Scientific Paper
   A. Introduction
   B. Study Area
   C. Literature Review
   D. Methods
   E. Results
   F. Discussion
   G. Conclusions
IV. Field Investigations
   A. The scientific method
   B. Selecting a problem
   C. Designing a measurable hypothesis
   D. Sampling procedures
   E. Analyzing the results
      1. Statistical methods
      2. Process/response modeling
   F. Organizing the results
V. Field Projects/use of techniques
   A. GIS Soil Analysis of clay soils in Denver
   B. Water quality assessment of Cherry Creek
   C. Air Quality in Downtown Denver
   D. Total Station Surveying
   E. Ecology: measuring species richness, diversity, and abundance
VI. Site Visits
   A. Water Treatment Facility
   B. Denver Landfill
   C. Rocky Flats
   D. Climate Change in Rocky Mountain National Park
   E. Wind farm
   F. Environmental Policy – State Legislature
   G. Excel Energy and burning of fossil fuels
   H. Dillon Reservoir – Denver water Supply
   I. Mountain mining facilities – acid mine drainage

VII. Research proposal preparation

VIII. Proposal Presentations

Evaluation of Student Performance:

1. A 15-20 page research proposal
2. Written lab reports
3. Student Proposal Presentation
REQUEST FOR NEW OR CONTINUED SENIOR EXPERIENCE DESIGNATION

SENIOR EXPERIENCE

(To accompany old and new regular syllabus form and Curriculum Change Proposal forms)

Date: 4/4/2008
School: Letters, Arts, and Sciences
Department: Earth and Atmospheric Sciences

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Course Number</th>
<th>Credit Hours</th>
<th>Contact Hours</th>
<th>CIP Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENV</td>
<td>4970</td>
<td>3</td>
<td>135</td>
<td>03.0104</td>
</tr>
</tbody>
</table>

Title: Environmental Field Studies

Prerequisites: 12 hours of upper-division courses in geology, physical geography, biology, and/or meteorology or written permission of instructor; completion of all Level I and Level II General Studies course requirements, senior standing

Corequisites: None

Recommended maximum enrollment per section: 20

Current Course Status (check all that apply)
☐ New course
☒ Existing Senior Experience Course

Criteria for Senior Experience

The following criteria must be addressed for all courses seeking Senior Experience designation. Please type on this form; it will expand to accommodate any length of text.

The Senior Experience must allow students to:

1. synthesize learning through critical analysis and logical thinking.
   Classes will be designed to implement environmental science field techniques. Students will obtain field data, and then analyze the data in a laboratory setting. A formal lab write-up describing the introduction to the problem, methods, results, discussion, and conclusions will be required for each exercise. Students will also prepare a research proposal based on an environmental issue in Colorado. They will critically evaluate results presented in scientific journals and formulate a research objective.
2. apply theoretical constructs to practical applications.

Global environmental issues will be evaluated in the context of those that occur in Colorado. Field site visits to local environmental sites will enhance student understanding of real world, local issues. Students will then apply the scientific literature to local environmental problems. This process will make them marketable for future employment.

3. critique philosophical tenets and current practices.

Students will write a research proposal on a topic related to the student’s interest. The majority of citation in this paper will be from scientific journals. Therefore, students must critically evaluate results from previously published research and judge the relevancy to the proposal. Through conducting lab experiments, the precision and accuracy of field sampling techniques will be examined.

4. integrate and refine oral and/or written communication skills.

Students will improve their writing skills through lab reports and preparation of a 15 – 20 page research proposal. Research proposals will be presented to the class in 20 minute sessions, improving student’s oral communication skills.

5. verify their expertise.

The course will provide students with a comprehensive background in the field techniques needed to investigate environmental science problems. The field experiments are designed to reinforce principles learned in previous biology, chemistry, geology, GIS, and environmental science courses.

Approvals:

Department Curriculum Committee / Date

Department Chair OR Program Director / Date

School Curriculum Committee / Date

Dean or Associate Dean / Date

Chair, Faculty Senate Curriculum Committee / Date

Associate Vice President, Academic Affairs/Date
To: Curriculum Review Committees

From: Jason Janke, Environmental Science Program
Department of Earth and Atmospheric Sciences

Subject: ENV 1200 – Introduction to Environmental Science – General Studies Designation

Date: February 7, 2011

In the following packet, you will find the required forms and supporting documentation for a Natural and Physical Sciences General Studies designation for ENV 1200 – Introduction to Environmental Science. The course has previously been a part of the past general studies program; therefore, it will require no new resources. However, the course has been revised to meet new learning outcomes of the 2012 general studies program. The Earth and Atmospheric Sciences Department hopes to continue to support the general studies program by offering diverse, multidisciplinary courses such as Introduction to Environmental Science.

Thank you for consideration of this proposal.

Sincerely,

Jason R. Janke, Ph.D.
Associate Professor
Metropolitan State College of Denver
Director, Environmental Science Program
Department of Earth and Atmospheric Sciences
Email: jjanke1@mscd.edu
Phone: 303-556-3072
The Metropolitan State College of Denver

Signature Cover Sheet

Substantive Curriculum Change Proposal

Academic Year: 2011-2012

School of: LAS

Department: EAS

Approved:

Jason John 2/7/11/4/7/11
Chair, Department Curriculum Committee Date

Kerry Engle 4/17/11
Chair, Department OR Program Director Date

Chad E. Routt 4/11/11
Chair, School Curriculum Committee Date

Sandra Young-Carrillo 4/14/11
Dean OR Associate Dean Date

Chair, Faculty Senate Curriculum Committee Date

President, Faculty Senate Date

Associate Vice President, Academic Affairs Date

Short Summary of the Changes Proposed (assistance available from Dean's Office):

Course Modification – ENV 1200 Introduction to Environmental Science

General Studies – Natural and Physical Sciences designation

Are any of these changes the result of Assessment findings?

☐ YES ☐ NO

☐ Approved – President (if applicable) Date:

☐ Approved – Board of Trustees (if applicable) Date:
<table>
<thead>
<tr>
<th>Prefix/Number</th>
<th>Course Title</th>
<th>Current Catalog Description</th>
<th>Proposed Catalog Description</th>
<th>Rationale for Modification</th>
</tr>
</thead>
</table>
| ENV 1200 CIP: 40.0601 | Introduction to Environmental Science 3 (3+0) | **Prerequisite(s):** minimum performance standard scores on reading, writing, and mathematics preassessment placement tests  
**Corequisites(s):** None  
**Course Description:** This course is an introduction to the study of the physical environment and some of the major related issues and problems. The areas of concern include the nature of the environment, climatic factors, agriculture, solid and hazardous waste site location, global environmental hazards, land use, water resources, and energy and mineral resources, as well as environmental ethics and management and decision making. (General Studies—Level II, Natural Science) (GT-SC2) | **Course Description:** This course introduces students to environmental concepts and issues from an interdisciplinary approach. Students will gain an understanding of the scientific methods and techniques needed to understand and analyze environmental issues such as ecology, human population growth, soils and agriculture, deforestation, urbanization, air pollution, freshwater resources, ocean pollution, climate change, fossil fuels, alternative energy sources, waste disposal as well as environmental ethics and policy. Course topics will be complemented with computer exercises. (General Studies - Natural and Physical Sciences). | • Course content has been revised to match general studies learning outcomes  
• New textbook adopted  
• New technologies have been added to the course |

_x_ Modification of this course does not affect any other department.

___ Modification of this course affects the following departments (Notified – Yes/No?):

1.
REGULAR COURSE SYLLABUS

School of: Letters, Arts, and Sciences
Department: Earth and Atmospheric Sciences
Prefix & Course Number: ENV 1200

Course Title: Introduction to Environmental Science

Check All That Apply: Required for Major: X  Required for Minor: X  Specified Elective: X
Required for Concentration:  Elective: X  Service Course: X

Credit Hours: 3 (3+0)

Total Contact Hours per semester (assuming 15-16 week semester):
Lecture 45  Lab 0  Internship 0  Practicum 0  Other (please specify type and hours): 0

Schedule Type(s): L  Grading Mode(s): L

Variable Topics Courses (list restrictions, including the maximum number of hours that can be earned**):
NA

** NOTE: This information must be included in the course description.

Restrictions (Variable Topics Course): NA

Prerequisite(s): Minimum performance standard scores on reading, writing, and mathematics preassessment placement tests
Corequisite(s): None
Prerequisite(s) or Corequisite(s): None

Banner Enforced:

Prerequisite(s): None
Corequisite(s): None
Prerequisite(s) or Corequisite(s): None

Catalog Course Description:
This course introduces students to environmental concepts and issues from an interdisciplinary approach. Students will gain an understanding of the scientific methods and techniques needed to understand and analyze environmental issues such as ecology, human population growth, soils and agriculture, deforestation, urbanization, air pollution, freshwater resources, ocean pollution, climate change, fossil fuels, alternative energy sources, waste disposal as well as environmental ethics and policy. Course topics will be complemented with computer exercises.

APPROVED: 4/7/10
Department Chair OR Program Director  4/14/11
Dean OR Associate Dean

Associate VP, Academic Affairs

*If crosslisted, attach completed Course Crosslisting Agreement Form
Required Reading and Other Materials will be equivalent to:


Specific, Measurable

Student Behavioral Learning Objectives:
(Relation to specific General Studies student learning outcomes are listed in parentheses)

Upon completion of this course, students will be able to:

1. Identify the major components of the physical environment (19);
2. Discuss the scientific method in relation to assessing the environment (10, 11, 19, 20, 21);
3. Explain the issues and approaches to decision-making on environmental and resource matters (2, 10);
4. Explain important environmental topics dealing with human population growth, soil resources, biodiversity, urban growth, freshwater, oceans, air quality, and climate change (2, 10, 11, 19);
5. Evaluate the benefits and impacts of energy sources including coal, oil, natural gas, nuclear power, geothermal power, wind energy, solar power, and other alternative sources (2, 10, 11, 19, 20);
6. Analyze numerical data presented in graphs and maps and interpret statistical data (1, 10, 11, 19, 20, 21);
7. Exhibit proficient use of technology through online learning modules (1, 19)

Detailed Outline of Course Content (Major Topics and Subtopics)
1. Foundations of Environmental Science
   a. Introduction to Environmental Science (2, 10, 11, 20, 21)
   b. Environmental Ethics and Policy (2, 10, 19)
   c. Chemistry to Energy to Life (10, 11, 20, 21)
   d. Evolution, Biodiversity, and Population Ecology (1, 2, 10, 11, 20, 21)
   e. Species Interactions and Community Ecology (1, 2, 10, 11, 20, 21)
   f. Environmental Systems and Ecosystem Ecology (1, 2, 10, 11, 20, 21)
2. Environmental Issues - the Search for Solutions
   a. Human Population (1, 2, 11, 19, 20, 21)
      i. Demography
      ii. Population and Society
   b. Soils and Agriculture (1, 10, 11, 19, 20, 21)
      i. Soil as a System
      ii. Soil Degradation
      iii. The Race to Feed the world
      iv. Genetic Modification of Food
      v. Aquaculture
      vi. Sustainable Agriculture
   c. Biodiversity and Conservation Biology (10, 19, 20)
i. Biodiversity Loss and Species Extinction
ii. Conservation Biology
d. Resource Management (10, 11, 19)
   i. Forestry
   ii. Land Use
   iii. Protected Areas
e. Urbanization and Creating Livable Cities (1, 10, 11)
   i. Sprawl
   ii. Creating Livable Cities
   iii. Urban Sustainability
f. Freshwater Resources (1, 2, 10, 11, 19, 20, 21)
   i. How we use water
   ii. Solutions to freshwater depletion
   iii. Freshwater pollution
   iv. Wastewater and its Treatment
g. The Oceans (10, 11)
   i. Oceanography
   ii. Marine Ecosystems
   iii. Human Use and Impact
   iv. Marine Conservation Biology
h. Atmospheric Science and Air Pollution (1, 2, 10, 11, 19, 20, 21)
   i. Outdoor Air Pollution
   ii. Indoor Air Pollution
i. Global Climate Change (1, 2, 10, 11, 19, 20, 21)
   i. Methods of Studying Climate Change
   ii. Climate Change Estimates
   iii. Debates
   iv. Reduced Emissions
j. Fossil Fuels (10, 11, 19, 20, 21)
   i. Coal
   ii. Oil
   iii. Natural Gas
   iv. Environmental Impacts
k. Conventional Energy Alternatives (10, 11, 19, 20, 21)
   i. Nuclear Power
   ii. Biomass Energy
   iii. Hydroelectric Power
l. New Renewable Energy Alternatives (1, 2, 10, 11, 19, 20, 21)
   i. Solar
   ii. Wind
   iii. Geothermal
   iv. Oceans
m. Waste Management (1, 2, 10, 11, 19)
   i. Solid Waste
   ii. Industrial Waste
   iii. Hazardous Waste

Evaluation of Student Performance (format: I, a, i, ii, etc.):
1. Examinations on the scientific material presented
2. Homework/In-class written assignments that focus on gathering, analyzing, interpreting, and
displaying scientific data
3. Online learning modules (optional)
4. Evaluation may also include quizzes or class participation
REQUEST FOR GENERAL STUDIES DESIGNATION (2010-11)
NATURAL AND PHYSICAL SCIENCES

Please review the Course Selection Criteria for this category for assistance in completing this form, particularly as it relates to the percentages associated with each Student Learning Outcome.

If this course is also being submitted for the Global Diversity Category, check here □, and complete and attach the separate Global Diversity General Studies Designation request.

Date: 1/24/11

School: LAS

Department: EAS

<table>
<thead>
<tr>
<th>Prefix</th>
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<th>Credit Hours</th>
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<tbody>
<tr>
<td>ENV</td>
<td>1200</td>
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</tbody>
</table>

Title: Introduction to Environmental Science

Prerequisite(s): Minimum performance standard scores on reading, writing, and mathematics placement tests

Corequisite(s): None

Banner enforced prerequisite(s) and/or corequisite(s): None

Recommended maximum enrollment per section: 30
A. Student Learning Outcomes

Describe the specific ways in which this course addresses each of these Student Learning Outcomes, providing students opportunities to develop the skills and/or acquire the knowledge. Include reference to readings, discussions, lectures, and other pedagogical tools which will be used. See the Criteria Table for examples.

1. Demonstrate effective use of technologies appropriate to the task and discipline. (10%) 
   - Students are expected to:
     - Complete supplemental online environmental science exercises,
     - Manage assignments, announcements, or lecture notes via the WebCT Vista or Luminis Platform,
     - Utilize learning modules on the publisher’s website (practice quizzes, flashcards, case studies, virtual field trips, etc.),
     - Conduct internet searches for scientific publications and/or data,
     - Communicate with their instructor via the campus email system,
     - Use appropriate library research tools such as databases, and
     - Display scientific data using spreadsheets or graphing software.

2. Demonstrate the ability to locate sources when information is needed, and to evaluate the authenticity, validity, and reliability of resources applied to a specific purpose. (10%) 
   - Students will be required to gather information for written reports or exercises. In all cases, students must demonstrate an understanding of validity as expressed by the peer review process and distinguish between primary and secondary sources.

10. Describe how the methods of science are used to generate new knowledge. (30%) 
   - The historical context of environmental science will provide many examples of how the science has evolved. The following topics illustrate how science can be used to generate new knowledge:
     i. Steps in the scientific method
     ii. Speciation
        1. A discussion of how evolution and Darwin’s ideas have transpired.
        2. New species have been discovered through use of DNA analysis (not previously possible)
     iii. Pollution (air, water, soil, oceans)
        1. A discussion of laws and regulations and how pollution reduction has been improved through education and technology
        2. Hands-on activities where students gather data about water quality, air pollution, or soil conditions will improve students’ ability to hypothesize, distinguish between descriptive and experimental science, and categorize data.
     iv. Energy
        1. What we have depended on: Fossil Fuels
2. What may be a solution: Alternative energy sources (nuclear, geothermal, etc.)
3. Where we are going: Renewable energy sources (wind, solar, hydrogen)

11. Use graphical, symbolic and statistical methods to organize, analyze and interpret data in a manner appropriate to the discipline. (25%)

- Students are expected to participate in hands-on activities to gather data about water quality, air pollution, or soil conditions. Dependent and independent variables will be identified. Students must summarize results through graphs and calculate basic statistics on the dataset.
- Students must complete supplemental online learning modules which highlight how to display and interpret environmental data.

19. Describe the foundational knowledge and impacts of a field of science using analytical tools appropriate to the field. (60%)

- Students are expected to understand the foundations and issues of the following topics that pertain to environmental science:
  - Ecology
  - Human Population growth
  - Sustainable urban areas
  - Pollution (water, air, soil, oceans)
  - Climate Change
  - Energy (fossil fuels and renewable energy)
  - Waste Management

20. Use knowledge and observations to formulate hypotheses, identify relevant variables and design experiments to test hypotheses. (10%)

- Students will conduct exercises that illustrate the scientific method. Students gather data and hypothesize what might be causing outliers or attempt to explain why a particular pattern exists. For example, water samples may indicate that the pH of water entering Cherry Creek is more acidic than the main stream channel. What has caused the pH to be lower in the entering water? Is the soil the source? Is the fertilizer the source? Students must identify important variables and speculate as to what might be the cause.

21. Develop concepts of accuracy, precision, and the role of repeatability in the acquisition of scientific data. (10%)

- These concepts will be explicitly addressed in the beginning of the course within the context of the scientific method. The concepts will be reinforced during hands-on exercises. Students will be asked to repeat measurements or compare findings with other groups to determine instrument accuracy and precision.
B. Assessment of Student Learning

Identify and describe at least one specific form of assessing student achievement of each Student Learning Outcome which will be a regular part of the course. Include attachments as applicable. A single piece of student work may be used to assess student achievement of more than one Student Learning Outcome. See the Criteria Table for potential data for use in assessment.

1. Demonstrate effective use of technologies appropriate to the task and discipline.
   - Online supplemental exercises (Attachment 1 – students explore environmental topics via Adobe flash learning modules. Students submit their answers online.)
   - Written reports that require use of spreadsheets or graphing software (Attachment 2 – in this assignment, students gather data about water quality and graph their results.)
   - Homework/Problem Sets/Quiz/Examination/Writing Assignment submissions via the WebCT Vista platform or via email attachments

2. Demonstrate the ability to locate sources when information is needed, and to evaluate the authenticity, validity, and reliability of resources applied to a specific purpose.
   - In-class case studies – students read two short viewpoints and must decide who is correct. For example, there is a debate whether excess nitrogen or extra phosphorus causes more eutrophication (excess algae growth in water). Students read two opposing viewpoints, discuss in small groups, and must reach a consensus as to who is correct.
   - Writing assignments (Attachment 4 – Students watch An Inconvenient Truth and compare facts from the movie with those published on a website and another anti-global warming published article.)

10. Describe how the methods of science are used to generate new knowledge.
   - Written exercises are designed to evaluate whether students can describe and complete the important steps in the scientific method, make hypotheses, describe relevant methods, and discern between descriptive and experimental science (Attachment 2/3 – Water Quality/Air Pollution Exercise).
   - Discussions/lectures/course readings will reinforce the learning outcome.
   - Examinations

11. Use graphical, symbolic and statistical methods to organize, analyze and interpret data in a manner appropriate to the discipline.
   - Written assignments require displaying and analyzing environmental data (Attachment 2/3).
   - Discussions/lectures/course readings that display figures such as:
     - Reduction in sulfur dioxide emissions over time
     - Species extinction over time
     - Correlation between number of children born and education
     - Pollution produced by transportation to cities
Pie charts of energy usage

- Examinations that require interpretation of figures/graphs (Attachment 5).

19. Describe the foundational knowledge and impacts of a field of science using analytical tools appropriate to the field.

- Examinations will assess the student’s understating and applications of environmental science themes (Attachment 5).
- Discussions/lectures/course readings will provide students with exposure to terminology, basic and applied science, and unintended consequences of scientific applications (such as how the green revolution improved agricultural production, but today we are discovering the consequences associated with using pesticides, herbicides, or other chemicals).
- Hands-on exercises/demonstrations will illustrate how to sample air quality, soil properties, etc. using analytical tools (Attachment 2/3).

20. Use knowledge and observations to formulate hypotheses, identify relevant variables and design experiments to test hypotheses.

- Writing assignments that mimic the scientific process (Attachment 2/3)
- Discussions/lectures/course readings that highlight important variables being analyze and potential causes.
- Examinations that require interpretation of data.


- Writing assignments that require students to obtain data and reflect on its accuracy (Attachment 2/3)
- Discussions/lectures/course readings that define error, precision, and accuracy.
- Examinations that require interpretation of uncertainty.

C. Conformance with Course Selection Guidelines

Briefly describe how the course meets the course section guidelines

☐ The course must meet the full requirements of the Student Learning Outcomes, or must be paired with a corequisite lab course that, as a pair complete the outcomes.

- The course is a stand-alone course with no corequisite lab. As documented above, the course addresses each of the student learning outcomes.

☐ The course does not require a prerequisite within the discipline (or provide justification if it is an essential prerequisite).

- The course has no prerequisites other than minimum placement scores.
Approvals:

Department Curriculum Committee / Date

Department Chair or Program Director / Date

School Curriculum Committee / Date

Dean or Associate Dean / Date

Chair, General Studies Committee / Date

Associate Vice President, Academic Affairs / Date
METROPOLITAN STATE COLLEGE of DENVER

Substantive Curriculum Change Proposal

APPENDIX

Academic Year: 2011-2012
School of: LAS
Department: EAS
Date: 2/7/11
Welcome to the Geographic Information System (GIS) exercise portion of your Introduction to Environmental Science course. These modules consist of a set of short (completed in 30 – 45 minutes) GIS exercises that will be used to enhance your course materials.

After completing these exercises, you will:
- Improve your computer skills by processing GIS in small groups.
- Be able to localize environmental issues at local, regional, and global scales.
- Gain a better understanding of environmental problems and the physical environment in which we live.
- Enhance your critical thinking and analysis skills.

**Modules**
- What is GIS?
- Invasive Species
- Population Ecology
- Agriculture & Soils
- Water Resources
- Air Quality
- Global Warming
- Sustainability

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**Invasive Species**

Red dots indicate zebra mussel locations.

Notice the correlation between rivers and zebra mussel locations in the Eastern US.
Writing Assignment #5: Water Quality

Phosphorus is a nutrient that acts as a fertilizer for aquatic plants. When nutrient levels are high, excessive plant and algae growth creates water quality problems. Phosphorus occurs in natural waters in the form of phosphate (PO4). Over half of the phosphates in lakes, streams, and rivers come from detergents. Phosphate levels higher than 0.03 ppm contribute to increased plant growth.

The pH test is one of the most common analyses in water testing. pH is a measurement of the activity of hydrogen ions in a water sample. The pH scale ranges from 0 to 14. Water samples with a pH below 7.0 are considered acidic, those above 7.0 are basic, with 7.0 considered neutral.

A pH range of 6.5 to 8.2 is optimal for most aquatic organisms. Rapidly growing algae and vegetation remove carbon dioxide (CO2) from the water during photosynthesis. This can result in a significant increase in pH. Most natural waters have pH values from 5.0 to 8.5. Acidic, freshly fallen rain water may have a pH of 5.5 to 6.0. Alkaline soils and minerals can raise the pH to 8.0 to 8.5. Sea water usually has a pH value close to 8.0.

Nitrogen is a nutrient that acts as a fertilizer for aquatic plants. When nitrogen levels are high, excessive plant and algae growth creates water quality problems. Nitrogen enters the water from human and animal waste, decomposing organic matter, and lawn and crop fertilizer run-off. Nitrogen occurs in water as Nitrate (NO3), Nitrite (NO2), and Ammonia (NH3).

Chloride is one of the major anions found in water and sewage. The presence of chlorides in large amounts may be due to the natural process of water passing through salt formations in the earth, or it may be evidence of the intrusion of sea water or pollution from industrial or domestic wastes. Chloride gives water a salty taste. Drinking water standards recommend a maximum chloride concentration of 250 ppm. Salinity is an important water quality measurement that is related to chloride. It is the total of all salts dissolved in water. The salt content of water affects the distribution of plant and animal life in an aquatic system, based on the amount of salt they can tolerate. Salinity can be calculated from chloride concentrations, and is usually expressed as parts-per-thousand (ppt), ranging from 0 ppt in freshwater, up to 35 ppt in sea water.

Fish, invertebrates, plants, and aerobic bacteria all require oxygen for respiration. Oxygen dissolves readily into water from the atmosphere until the water is saturated. Once dissolved in water the oxygen diffuses very slowly, and distribution depends upon the movement of the aerated water. Oxygen is also produced by aquatic plants, algae, and phytoplankton as a by-product of photosynthesis. Aquatic organisms require different amounts of dissolved oxygen. Dissolved oxygen levels below 3 ppm are stressful to most aquatic organisms. Dissolved oxygen levels below 2 or 1 ppm will not support fish. Levels of 5 to 6 ppm are usually required for the growth and activity of aquatic organisms.
The particulate matter carried by a stream determines its **turbidity**, or the relative muddiness or cloudiness of the water. Particulates in a stream consist of algae, sediment particles from erosion, coarse particulate organic matter (CPOM) such as leaves and twigs, and fine particulate organic matter (FPOM) that has been broken down by stream biota. Erosion is a natural geologic process. However, certain human activities such as farming, storm water discharge, and construction greatly increase the amount of erosion in a watershed. The increased sediment from these erosive activities blankets the stream bottom and destroys spawning areas and macroinvertebrate habitat. Sediment can also be resuspended into the water column by bottom feeders like carp or by walking through the stream. Suspended sediment blocks light needed by rooted aquatic plants, damages gills on fish and invertebrates, and decreases visibility for fish who must see their prey. Sediments can also carry adhered pollutants, such as heavy metals and phosphorus, into the stream.
When writing your paper, follow these guidelines!

**Introduction**
- Why is important to monitor water quality?
- What variables did we measure? i.e. why would we measure phosphorous concentrations?

**Methods**
- Describe how we sampled the water.
- Where were the samples obtained?

**Results**
- What did you discover? Are all sites contaminated? Is there anything that stands out in terms of highs and lows?
- Include the table below in this section.
- Include graphs or figures as well.

<table>
<thead>
<tr>
<th>Phos.</th>
<th>pH</th>
<th>Ammonia</th>
<th>Nitrate</th>
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<th>Turbidity</th>
<th>Dissolved oxygen</th>
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</tbody>
</table>

**Conclusions**
- Summarize your most important findings.
ATTACHMENT #3

Writing Assignment #8: Air Quality

Introduction

Poor air quality in the Denver Metropolitan region is affected by mobile sources and a combination of environmental variables (high elevation, clear skies, and temperature inversions) which form and trap pollutants in the troposphere (Blanken et al. 2001). As a result, it is important to measure air quality parameters such as nitrogen dioxide (NO₂), sulfur dioxide (SO₂), carbon monoxide (CO), and ammonia (NH₃). Most NO₂ comes from automobiles. Excess air required for combustion adds nitrogen to the process and produces nitrous oxides (NOₓ). Nitrogen dioxide, when combined with water vapor in the atmosphere, can form nitric acid, a component of acid precipitation. When exposed to UV radiation, nitrous oxides can form tropospheric ozone, a major constituent to brown smog in Denver. Since coal and petroleum often contain sulfur compounds, their combustion generates sulfur dioxide, another part of acid precipitation.

Carbon monoxide, which reduces the delivery of oxygen to the blood, is produced from the partial combustion of carbon-containing compounds. Carbon monoxide has an indirect forcing effect by elevating concentrations of methane and tropospheric ozone. Through natural processes in the atmosphere, it is eventually oxidized to carbon dioxide. Ammonia is produced from the breakdown of plant and animal matter as well as from industrial processes. When excess ammonia is deposited, a net increase in primary productivity results in terrestrial and aquatic ecosystems. Not only do these pollutants contribute to environmental degradation of ecosystems, but they also cause a variety of respiratory and heart problems (Koken et al. 2003).

The Front Range provides a unique setting to investigate orographic (mountain) effects on air quality (Jirak and Cotton 2006). Upslope winds from Denver deliver pollutants to high elevation sites. Nitrates generated in the Front Range urban areas are responsible for increased eutrophication (excess algae growth) in alpine lakes (Ingersoll et al. 2008; Nanus et al. 2008). Concentration and distribution of other pollutants have not been examined in the Front Range urban corridor and mountainous environments.
Written reports should be in the following format.

Introduction
What you are investigating? Why is it important to measure these parameters? What are the objectives of this lab?

Study Area
Where did your study take place? Describe the site locations.

Methods
Describe what you did to obtain your data. You should use scientific terminology to illustrate the methods utilized. Make sure you include enough detail so that I can follow your methods, but you do not need to every single step.

Results
Describe your findings. Be sure to illustrate this section with tables and figures. How accurate and precise are your measurements?

Conclusions
Interpret your results. Why does a particular pattern occur? How might time of year play a role? Is there spatial variability within the downtown? What might be the cause of this? What could you do to improve your study?

References
ATTACHMENT #4

Writing Assignment #7: Climate Change

Global warming is the increase in the average temperature of Earth's near-surface air and oceans since the mid-20th century and its projected continuation. According to the 2007 Fourth Assessment Report by the Intergovernmental Panel on Climate Change (IPCC), global surface temperature increased 0.74 ± 0.18 °C (1.33 ± 0.32 °F) during the 20th century. Most of the observed temperature increase since the middle of the 20th century has been caused by increasing concentrations of greenhouse gases, which result from human activity such as the burning of fossil fuel and deforestation. Global dimming, a result of increasing concentrations of atmospheric aerosols that block sunlight from reaching the surface, has partially countered the effects of warming induced by greenhouse gases.

Climate model projections summarized in the latest IPCC report indicate that the global surface temperature is likely to rise a further 1.1 to 6.4 °C (2.0 to 11.5 °F) during the 21st century. The uncertainty in this estimate arises from the use of models with differing sensitivity to greenhouse gas concentrations and the use of differing estimates of future greenhouse gas emissions. An increase in global temperature will cause sea levels to rise and will change the amount and pattern of precipitation, probably including expansion of subtropical deserts. Warming is expected to be strongest in the Arctic and would be associated with continuing retreat of glaciers, permafrost and sea ice. Other likely effects include changes in the frequency and intensity of extreme weather events, species extinctions, and changes in agricultural yields. Warming and related changes will vary from region to region around the globe, though the nature of these regional variations is uncertain. As a result of contemporary increases in atmospheric carbon dioxide, the oceans have become more acidic; a result that is predicted to continue.

The scientific consensus is that anthropogenic global warming is occurring. Nevertheless, political and public debate continues. The Kyoto Protocol is aimed at stabilizing greenhouse gas concentration to prevent a "dangerous anthropogenic interference". As of November 2009, 187 states had signed and ratified the protocol.
In class, we viewed Al Gore's movie, *An Inconvenient Truth*. Below you will find another perspective on the global warming debate. An article from a website along with an article published in a peer-reviewed academic journal (well-respected) are provided.

*Here's your assignment:*

Based on your knowledge of climate change as well as the evidence presented in the attached documents, defend or refute the following statement:

"Global warming is a consequence of increased greenhouse gas emissions from human sources."

Follow the same "rules" as before and upload your document to the WebCT Vista course site under the Assignments link.
Environmental Effects of Increased Atmospheric Carbon Dioxide

Arthur B. Robinson, Ph.D.
Noah E. Robinson, Ph.D.
Willie Soon, Ph.D.

ABSTRACT A review of the research literature concerning the environmental consequences of increased levels of atmospheric carbon dioxide leads to the conclusion that increases during the 20th and early 21st centuries have produced no deleterious effects upon Earth's weather and climate. Increased carbon dioxide has, however, markedly increased plant growth. Predictions of harmful climatic effects due to future increases in hydrocarbon use and minor greenhouse gases like CO₂ do not conform to current experimental knowledge. The environmental effects of rapid expansion of the nuclear and hydrocarbon energy industries are discussed.

Summary
Political leaders gathered in Kyoto, Japan, in December 1997 to consider a world treaty restricting human production of "greenhouse gases," chiefly carbon dioxide (CO₂). They feared that CO₂ would result in "human-caused global warming," hypothetical severe increases in Earth's temperature, with disastrous environmental consequences. During the past 10 years, many political efforts have been made to force worldwide agreement to the Kyoto treaty.

When we reviewed this subject in 1998, existing satellite records were short and were centered on a period of changing intermediate temperature trends. Additional experimental data have now been obtained, so better answers to the questions raised by the hypothesis of "human-caused global warming" are now available.

The average temperature of the Earth has varied within a range of about 3 °C during the past 3,000 years. It is currently increasing as the Earth recovers from a period that is known as the Little Ice Age, as shown in Figure 1. George Washington and his army were at Valley Forge during the coldest era in 1,500 years, but even then the temperature was only about 1 °C centigrade below the 3,000-year average.

![Figure 1. Surface temperatures in the Sargasso Sea, a 2 million square mile region of the Atlantic Ocean, with time resolution of 50 to 100 years and ending in 1975, as determined by isotopic ratios of marine organisms remains in sediments at the bottom of the sea. The horizontal line is the average temperature for this 3,000-year period. The Little Ice Age and Medieval Climate Optimum were naturally occurring, extended intervals of climate departures from the mean. A value of 0.25 °C, which is the change in Sargasso Sea temperature between 1975 and 2006, has been added to the 1975 data in order to provide a 2006 temperature value.](image1)

![Figure 2. Average length of 169 glaciers from 1700 to 2000. The principal source of melt energy is solar radiation. Variations in glacier mass and length are primarily due to temperature and precipitation. This melting trend lags the temperature increase by about 20 years, so it predicts the 6-fold increase in hydrocarbon use even more than shown in the figure. Hydrocarbon use could not have caused this shortening trend.](image2)

The most recent part of this warming period is reflected by shortening of world glaciers, as shown in Figure 2. Glaciers regularly lengthen and shorten in delayed correlation with cooling and warming trends. Shortening lags temperature by about 20 years, so the current warming trend began in about 1800.

Atmospheric temperature is regulated by the sun, which fluctuates in activity as shown in Figure 3, by the greenhouse effect, which is largely caused by atmospheric water vapor (H₂O) and by other phenomena that are more poorly understood. While major greenhouse gas H₂O substantially warms the Earth, minor greenhouse gases such as CO₂ have little effect, as is illustrated in Figures 2 and 3. The 6-fold increase in hydrocarbon use and CO₂ production since 1940 has had no noticeable effect on atmospheric temperature or on the trend in glacier length.

![Figure 3. Arctic surface air temperature compared with total solar irradiation as measured by sunspot cycle amplitude, sunspot cycle length, solar equatorial rotation rate, fraction of sunspot areas, and decay rate of the 11-year sunspot cycle. Solar irradiance correlates well with Arctic temperature, while hydrocarbon use does not correlate.](image3)
35 INCONVENIENT TRUTHS

The errors in Al Gore's movie

A spokesman for Al Gore has issued a questionable response to the news that in October 2007 the High Court in London had identified nine "errors" in his movie An Inconvenient Truth. The judge had stated that, if the UK Government had not agreed to send to every secondary school in England a corrected guidance note making clear the mainstream scientific position on these nine "errors", he would have made a finding that the Government's distribution of the film and the first draft of the guidance note earlier in 2007 to all English secondary schools had been an unlawful contravention of an Act of Parliament prohibiting the political indoctrination of children.

Al Gore's spokesman and "environment advisor," Ms. Kalee Kreider, begins by saying that the film presented "thousands and thousands of facts." It did not; just 2,000 "facts" in 93 minutes would have been one fact every three seconds. The film contained only a few dozen points, most of which will be seen to have been substantially inaccurate. The judge concentrated only on nine points which even the TJK Government, to which Gore is a climate-change advisor, had to admit did not represent mainstream scientific opinion.

Ms. Kreider then states, incorrectly, that the judge himself had never used the term "errors." In fact, the judge used the term "errors," in inverted commas, throughout his judgment.

Next, Ms. Kreider makes some unjustifiable ad hominem attacks on Mr. Stewart Dimmock, the lorry driver, school governor and father of two school-age children who was the plaintiff in the case. This memorandum, however, will eschew any ad hominem response, and will concentrate exclusively on the 35 scientific inaccuracies and exaggerations in Gore's movie.

Ms. Kreider then says, "The process of creating a 90-minute documentary from the original peer-reviewed science for an audience of moviegoers in the U.S. and around the world is complex." However, the single web-page entitled "The Science" on the movie's official website contains only two references to articles in the peer-reviewed scientific journals. There is also a reference to a document of the IPCC, but its documents are not independently peer-reviewed in the usual understanding of the term.
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) For primary energy, the major renewable sources in the United States are _________.
   A) wind and solar
   B) biomass and solar
   C) hydropower and geothermal
   D) hydropower and biomass
   E) geothermal and solar

2) The two "new" renewable energy sources that are most widely available throughout the United States are _________.
   A) wind and solar
   B) hydropower and biomass
   C) hydropower and wind
   D) hydropower and geothermal
   E) geothermal and biomass

Use Figure 21.1 to answer the following questions.

1) ________
2) ________
3) One conclusion that can be drawn from the figures is that _______.
   A) most of the wind energy is used for electricity generation
   B) of the total renewable energy available, geothermal energy is primarily used for purposes other than electricity generation
   C) solar energy is currently a major source for generation of electricity
   D) most of the available biomass energy is used for electricity generation
   E) only a small amount of the available hydropower energy is used for electricity generation

4) For primary energy, the major renewable sources in the United States are _______.
   A) biomass and solar
   B) hydropower and biomass
   C) wind and solar
   D) hydropower and geothermal
   E) geothermal and solar

5) The two "new" renewable energy sources that are most widely available throughout the United States are _______.
   A) wind and solar
   B) hydropower and geothermal
   C) hydropower and wind
   D) hydropower and biomass
   E) geothermal and biomass

6) One conclusion that can be drawn from the figures is that _______.
   A) most of the wind energy is used for electricity generation
   B) solar energy is currently a major source for generation of electricity
   C) most of the available biomass energy is used for electricity generation
   D) of the total renewable energy available, geothermal energy is primarily used for purposes other than electricity generation
   E) only a small amount of the available hydropower energy is used for electricity generation

7) "New renewables" are _______.
   A) wind, wood, alcohol
   B) coal, natural gas
   C) fusion, fission
   D) solar, wind, geothermal
   E) hydro, biomass

8) Solar represents a minuscule portion of U.S. energy production because of _______.
   A) technological limitations
   B) lack of investment
   C) poor potential for this energy source
   D) air and water pollution from this source of energy
   E) lack of scientific interest
9) A major obstacle to the establishment of wind farms near populated and scenic areas is  
   A) the lack of financial support for the construction of wind farms  
   B) the lack of large land areas needed to construct wind farms  
   C) not-in-my-backyard (NIMBY) syndrome  
   D) the lack of government support for the construction of wind farms  
   E) the lack of infrastructure to support wind-generated electricity  

10) One major reason for the lack of development in oceanic energy sources is  
   A) the lack of funding  
   B) the potential substantial negative impact on marine and estuarine ecosystems  
   C) that oceanic processes are not completely understood  
   D) the lack of technological advancement  
   E) the lack of political support  

11) Whether a hydrogen-based energy system is environmentally cleaner than a fossil fuel system depends on  
   A) the source of oxygen used for the process  
   B) the car driven  
   C) the amount of fossil fuels that are invested in long-term storage  
   D) governmental incentives for research  
   E) how the hydrogen is produced  

12) The nation currently with the most progressive renewable energy policies and also producing the greatest amount of solar power is  
   A) the U.S.  
   B) Saudi Arabia  
   C) Spain  
   D) Germany  
   E) Brazil
Read the following scenario and answer the questions below.

The local community in Luzerne County, Pennsylvania, had mixed reactions to the news that a new wind farm was being installed in 2005. Some were excited about the possibility of lower energy bills, some were concerned about the effects on the environment, and others wondered if there was enough local wind to make such an investment worthwhile. An average wind speed of 9 to 13 miles per hour is sufficient for most sizes of wind turbines. The power available in the wind is proportional to the cube of its speed, which means that doubling the wind speed increases the available power by a factor of eight.

13) If the wind speed averages 11 mph on Ashley Hill and 12 mph on Genevie Hill, then a turbine operating on Genevie Hill could, in theory, generate about ______ % more electricity than a turbine on Ashley Hill.
   A) 1  B) 33  C) 10  D) 50  E) 25

14) The oldest wind farm in Pennsylvania is Humboldt Industrial Park—the first commercial wind energy project in the mid-Atlantic region—which went online December 31, 1999. The two 65-kilowatt wind turbines were predicted to generate 200,000 kilowatt-hours of wind energy each year, displacing conventional electric generation that would otherwise produce 140 tons of carbon dioxide—the primary source of global climate change. Wind energy from these first two turbines also avoids the annual production of 800 pounds of nitrogen oxides and 1,900 pounds of sulfur dioxide, which are the major ingredients ______.
   A) in water pollution
   B) causing eutrophication
   C) in fertilizers
   D) in acid rain and ground-level ozone or smog
   E) damaging the ozone layer

15) The entire output of Humboldt Industrial Park was quickly sold to subscribers, and further wind energy parks were soon built in Mill Run, Somerset, and other places. Most of the distribution has gone to businesses, universities, and state agencies. This means that ______.
   A) renewable energy sources are not yet efficient enough to be used by homeowners
   B) consumers still do not trust alternative energy sources
   C) the costs associated with renewable energy sources can only be borne by large groups
   D) very few large institutions are concerned about the pollution and environmental degradation associated with using wind to generate electricity
ENV 1200: INTRODUCTION TO ENVIRONMENTAL SCIENCE
First Year Success Program

Instructor: Dr. Jason Janke
Name: Sarah Sutherland
Email: jjanke1@mscd.edu
Email: ssuther7@mscd.edu
Office: Science 2016
Office: Tivoli 444
Office Phone: 303-556-3072
Office hours: or by appointment
Office Hours: 9:30 – Noon on M/W
or by appointment
9:30 – 11:00 on T/R
Or by appointment

Linked Course:
Course: ENG 1010: Freshmen Comp: The Essay
Instructor: Trent Hudley
Email: hudleyt@mscd.edu
Office: King Center 411
303-556-3211

Course Description
This course introduces students to environmental concepts and issues from an interdisciplinary approach. Students will gain an understanding of the basic scientific method and techniques needed to understand and analyze environmental issues such as human population growth, soils and agriculture, deforestation, urbanization, air pollution, freshwater resources, ocean pollution, climate change, fossil fuels, alternative energy sources, waste disposal as well as environmental ethics and policy. Course topics will be complemented with computer exercises. (General Studies - Natural and Physical Sciences).

This course is part of the Metro State First Year Success Program (FYS). FYS provide students with many benefits designed to enrich their time here, such as linked courses, a collegial environment, supplemental programming, and enhanced support services designed to promote academic and personal success. If you have questions about the program, contact the FYS Program office at 303-352-4195 or visit http://www.mscd.edu/fys

Learning Goals
1. To provide students with the foundation to understand how our natural, global environment operates;

2. To prepare and train students to monitor and sample environmental conditions using modern technology and traditional techniques;

3. To develop a competency in oral communication and scientific writing;
4. To build life-long learning skills and scholarly inquiry so that students can critically assess and evaluate environmental problems and become leaders in their discipline; and

5. To prepare students for employment or a graduate degree so that they can shape our future.

Required Text

2. Janke, J. (2010), GIS exercises for Environmental Science with GIS: GreatRiver Technologies. Available at the bookstore or for purchase online.

Grading

<table>
<thead>
<tr>
<th>Points</th>
<th>Percentage</th>
<th>My Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 writing assignments</td>
<td>140</td>
<td>23%</td>
</tr>
<tr>
<td>Attendance of 10 hours of supplemental instruction</td>
<td>100</td>
<td>17%</td>
</tr>
<tr>
<td>Attendance at least 2 co-curricular or other events</td>
<td>50</td>
<td>8%</td>
</tr>
<tr>
<td>11 Assessments</td>
<td>110</td>
<td>18%</td>
</tr>
<tr>
<td>GIS Exercises</td>
<td>100</td>
<td>17%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>100</td>
<td>17%</td>
</tr>
<tr>
<td>Total</td>
<td>600</td>
<td>100%</td>
</tr>
</tbody>
</table>

Writing Assignments

Environmental Science topics provide a great opportunity to express your opinion through verbal and written means. Several topics can be controversial; other times, scientific data can be misinterpreted because of its complexity. Throughout the semester, we will explore a variety of environmental issues and themes. For the writing assignments, I will present you with a topic ...we will write, edit, refine, and improve your papers and watch your writing skills improve through the semester! Designated “writing days” as indicated on the course schedule will give you a chance to write, edit, and read others’ papers.

The Writing Center, located in King Center 310, can help you with any aspect of your writing, from generating ideas to supporting your arguments to organizing to editing for style. For the current schedule or to make an appointment, visit the Writing Center’s website: http://www.mscd.edu/~wriectr/ or call 303-556-6070.
Supplemental Instruction Hours
During the semester, you must visit the Supplemental Instructor, Sarah Sutherland, for at least 10 hours total (not all at once!). Sarah will help you with your writing assignments or help you better comprehend the course materials. She will keep track of your hours and report them to me at the end of the semester.

Co-curricular Events Description
Descriptions of some possible co-curricular events can be found here:
http://www.mscd.edu/fys/assets/pdf/FYS-SP11-Activities.pdf

If you would like to attend another environmental event, please get your instructors permission before attending the event.

In order to receive credit for this portion of your grade, submit a 1-paragraph summary of what you learned at the co-curricular event.

Assessments
The instructor will provide you with a packet of questions. During class, on your own time, or with the Supplemental Instructor, complete the Assessments for each of the topics covered. Sarah will grade your Chapter Assessments and help you understand why a particular response is correct. You may count these hours as supplemental instruction as well. Assessments are due on the dates listed on the course schedule.

GIS Exercises

To register for the GIS exercises, you will need to purchase an access code from the Auraria bookstore or purchase one online.

1. Go to following web address:  http://webcom2.grtxle.com/enviroscience

2. Once there, you may enter your access code (purchased from the bookstore) or purchase online materials with a Credit Card.
3. Fill in the appropriate information to complete the registration process.

4. In case you misplace it, write your email address, username, and password here.

   Username: __________________________

   Password: __________________________

   Email used during registration: _________________

---

**Final Exam**

For your final exam, you are going to create a website that illustrates some of the important material that you learned during the semester.

Web address: [http://students.weebly.com/](http://students.weebly.com/)

This website has a Graphic User Interface (GUI) that allows making a website easy! Through the toolbar buttons, you can click and drag elements onto your webpage. You can add pictures, text, videos, etc. as well as change the look and feel of your website design.
Throughout the semester, we have discussed a variety of problems that our environment faces. For each of the following issues, determine the most important environmental problem associated with the topic and a possible solution to the environmental problem. Do not simply copy and paste from other websites! You must create a tab or additional page for each of the following topics we discussed. The topics are listed below:

- Extinction
- Human Population
- Soils and Agriculture
- Sustainable cities
- Freshwater
- Oceans
- Climate Change
- Air Pollution
- Fossil Fuels
- Renewables

Policies/Information

Grading scale

- A standard 90, 80, 70, 60 grading scale will be used. For example:

  100 - 90 = A (540 points)  
  89 - 80 = B (480 points)  
  79 - 70 = C (420 points)  
  69 - 60 = D (360 points)

Posting Grades

- It is your responsibility to keep track of your grades. Use the column provided on the syllabus to track your scores. Under no circumstances will grades be given out over the phone, by email, or fax.
Lecture Policies

- The real key to learning involves an effective interaction between both the student and instructor. I am extremely excited about teaching this class-I want you to feel the same way! The lecture is intended, as much as possible, to be an interactive environment. Please feel free at any time during lecture to ask a question or make a comment. Conversely, you are expected to respond to discussion questions asked in class.

- Please do not disrupt lecture (talk to your neighbor during lecture, leave lecture early, show up 15 minutes late, answer your cell phone, send text messages, take a nap, get up multiple times during lecture, act like an immature adolescence, exhibit a poor/negative attitude, etc.).

Academic Honesty

- When cheating is discovered, the faculty member may give the student an F on the work involved or in the course. If further disciplinary action is deemed appropriate, the student will be reported to the dean of students.

- Plagiarism is the act of using someone else's words, pictures, ideas, or procedures without proper acknowledgement, or to present them as if they originated with you. In science and especially in academics, plagiarism is unacceptable. For example, copying from someone else's paper, copying and pasting information from the internet, and handing it in as if it were your own work is plagiarism. At this college, plagiarism constitutes a form of cheating, and will not be tolerated. If you are unsure whether to cite someone else's work as you work through an assignment, come talk with me about it.

Janke's Rules of Order

As an instructor for this class, I will...

- Come prepared to help you learn the information
- Create a comfortable, informal learning atmosphere
- Reasonably meet your demands under special circumstances
- Do whatever it takes to get you interested and learn

As a student in this class, I will...

- Put forth my best effort to learn the material (do the readings, assignments, labs to the best of your ability)
- Maintain and improve my effort through the semester (don't come to me the last week and ask for extra points to boost your grade)
- Not miss any classes, except in case of an emergency
- Enter this class with an openness to learn something new, even if this class has nothing to do with my major

*In summary, meet me halfway, and you will do fine in this class!
ADA Statement
The Metropolitan State College of Denver is committed to making reasonable accommodations to assist individuals with disabilities in reaching their academic potential. If you have a disability, which may impact your performance, attendance, or grades in this class and are requesting accommodations, then you must first register with the Access Center, located in the Auraria Library, Suite 116, 303-556-8387.

The Access Center is the designated department responsible for coordinating accommodations and services for students with disabilities. Accommodations will not be granted prior to my receipt of your faculty notification letter from the Access Center. Please note that accommodations are never provided retroactively (i.e., prior to the receipt of your faculty notification letter.) Once I am in receipt of your official Access Center faculty notification letter, I would be happy to meet with you to discuss your accommodations. All discussions will remain confidential. Further information is available by visiting the Access center website www.mscd.edu/~access.
Metropolitan State College of Denver Policies

Class Attendance on Religious Holidays

Students at MSCD who, because of their sincerely held religious beliefs, are unable to attend classes, take examinations, participated in graded activities or submit graded assignments on particular days shall without penalty be excused from such classes and be give a meaningful opportunity to make up such examinations and graded activities or assignments provided that advance written notice that the student will be absent for religious reasons is given to the faculty members during the first two weeks of the semester.

Nothing in paragraph one of this policy shall require MSCD faculty members to reschedule classes, repeat lectures or other ungraded activities or provide ungraded individualized instruction solely for the benefit of the students who, for religious reasons, are unable to attend regularly scheduled classes or activities. However, presentations, critiques, conferences, and similar activities involving individual students shall be scheduled to avoid conflict with such students' religious observances or holidays provided that reasonable advance notices of scheduling conflicts is given to faculty members.

Because classroom attendance and participation is an important aspect of learning, MSCD students should not register for courses if regularly scheduled classes or activities routinely conflict with their religious observances or holidays.

Family Educational Rights and Privacy Act

MSCD hereby gives notice that it has designated the following categories of personally identifiable information as directory information under section 438(a)(5)(b) of the Family Educational rights and Privacy Act of 1974 (FERPA). Subject to the Colorado Public Records Act, directory information concerning students as the college may be released without prior consent of the student as permitted by FERPA unless within ten days after registration as student had notified MSCD (Office of the Registrar) that such information should not be released without his or her consent. Directory information at MSCD is as follows:

Name/Address/Dates of Attendance/ Degrees Received

Requests for disclosure of the directory information must be submitted in writing to the MSCD Office of the Registrar. In the case of emergencies, directory information may be released without written request, at the college's discretion. Prospective employers or their agents may request information concerning verification of student degrees received or dates of attendance directly from the MSCD Office of the Registrar without submitting a written request to the college.

Important Dates

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tue. Jan 4</td>
<td>Late fee for Spring 2011 registration begins (full term classes only)</td>
</tr>
<tr>
<td>Tue. Jan 18</td>
<td>Classes begin</td>
</tr>
<tr>
<td>Mon. Jan 24</td>
<td>Last day to drop full-term courses with 100% refund</td>
</tr>
<tr>
<td>Mon. Jan 24</td>
<td>Last day to submit a petition for In-State Tuition</td>
</tr>
<tr>
<td>Wed. Jan 26</td>
<td>Last day to be placed on a Wait List</td>
</tr>
<tr>
<td>Fri. Jan 28</td>
<td>Deadline to file Spring 2011 Application for Graduation</td>
</tr>
<tr>
<td>Wed. Feb 2</td>
<td>Census Day</td>
</tr>
<tr>
<td>Wed. Feb 2</td>
<td>Last day to drop full-term courses with 50% refund and have classes deleted from your record.</td>
</tr>
<tr>
<td></td>
<td>Last day to request a Pass/Fail</td>
</tr>
<tr>
<td>March 21-27</td>
<td>Spring Break</td>
</tr>
<tr>
<td>Mon. April 4</td>
<td>Last day to withdraw from full-semester classes and receive an ‘NC’</td>
</tr>
<tr>
<td>Sat. May 7</td>
<td>Last day of classes</td>
</tr>
<tr>
<td>May 9-14</td>
<td>Finals Week</td>
</tr>
<tr>
<td>Thu. May 19</td>
<td>Grades due from faculty by noon</td>
</tr>
<tr>
<td>Fri. May 20</td>
<td>Grades available on Web</td>
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<tr>
<td>Date</td>
<td>Topic</td>
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<tr>
<td>----------</td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>1/18</td>
<td>Syllabus</td>
</tr>
<tr>
<td>1/20</td>
<td>What is Environmental Science?</td>
</tr>
<tr>
<td>1/25</td>
<td>Population/Community Ecology</td>
</tr>
<tr>
<td>1/27</td>
<td>Video: Biomes Case Study</td>
</tr>
<tr>
<td>2/1</td>
<td><strong>Writing Day</strong></td>
</tr>
<tr>
<td>2/3</td>
<td>Human Population</td>
</tr>
<tr>
<td>2/8</td>
<td><strong>Writing Day</strong></td>
</tr>
<tr>
<td>2/10</td>
<td>Organic Agriculture</td>
</tr>
<tr>
<td>2/15</td>
<td>Field: Soils Data Collection</td>
</tr>
<tr>
<td>2/17</td>
<td><strong>Writing Day</strong></td>
</tr>
<tr>
<td>2/22</td>
<td>Urbanization and Creating Livable Cities</td>
</tr>
<tr>
<td>2/24</td>
<td>Video: The Urban Explosion</td>
</tr>
<tr>
<td>3/1</td>
<td><strong>Writing Day</strong></td>
</tr>
<tr>
<td>3/3</td>
<td>Freshwater</td>
</tr>
<tr>
<td>3/8</td>
<td>Video: Rivers of Destiny</td>
</tr>
<tr>
<td>3/10</td>
<td>Water Quality in Denver</td>
</tr>
<tr>
<td>3/15</td>
<td><strong>Writing Day</strong></td>
</tr>
<tr>
<td>3/17</td>
<td>Oceans</td>
</tr>
<tr>
<td>3/22</td>
<td><strong>Spring Break</strong></td>
</tr>
<tr>
<td>3/24</td>
<td><strong>Spring Break</strong></td>
</tr>
<tr>
<td>3/29</td>
<td>Atmospheric Science and Air Pollution</td>
</tr>
<tr>
<td>3/31</td>
<td>Denver's Air Quality Data Collection</td>
</tr>
<tr>
<td>4/5</td>
<td><strong>Writing Day</strong></td>
</tr>
<tr>
<td>4/7</td>
<td>Global Climate Change</td>
</tr>
<tr>
<td>4/12</td>
<td>An Inconvenient Truth</td>
</tr>
<tr>
<td>4/14</td>
<td>An Inconvenient Truth</td>
</tr>
<tr>
<td>4/19</td>
<td><strong>Writing Day</strong></td>
</tr>
<tr>
<td>4/21</td>
<td>Fossil Fuels/Nuclear/Hydro/Biomass</td>
</tr>
<tr>
<td>4/26</td>
<td>Renewables</td>
</tr>
<tr>
<td>4/28</td>
<td>Waste Management</td>
</tr>
<tr>
<td>5/3</td>
<td><strong>Prep Day for Final</strong></td>
</tr>
<tr>
<td>5/5</td>
<td><strong>Prep Day for Final</strong></td>
</tr>
<tr>
<td>May 9-14</td>
<td><strong>Finals Week</strong></td>
</tr>
</tbody>
</table>

*Assessments and assignments are due in class on the day listed on the schedule.
Current General Studies Form

GENERAL STUDIES COURSE PROPOSAL FORM
(To Accompany Regular Syllabus Form)

Check one of the following: [ ] New course [X] Current course with revisions [ ] Current course without revisions

Date March 9, 1990.

LEVEL [ ] I [X] II [ ] III

CATEGORY [ ] English 101 [X] English 102 [ ] Mathematics
[ ] English 102 [ ] Communications [ ] Arts and Letters
[ ] Historical [X] Social Science [X] Natural Science
[ ] Social Science [ ] History [X] Natural Science
[ ] Social Science [ ] English [ ] Natural Science
[ ] History [ ] English [ ] Natural Science
[ ] History [X] English [X] Natural Science

Prefix & Course Number GEG 120 Department Earth Sciences

Title Introduction to Environmental Sciences CIP 01 02 03

Prerequisites/Corequisites Minimum performance standard on the reading, writing, and mathematics placement tests.

Anticipated Number of Sections per Semester 1-2 Recommended Maximum Enrollment per Section 35

School Letters, Arts, and Sciences

I. Describe how the course will address the criteria listed for the category for which this course is being proposed.

1. a. preparation of charts and graphs from sample data and making predictions about future trends.
   b. reading and interpretation of maps, charts and graphs.
   c. preparation of surveys, collection of data and analysis of results.

2. a. utilization of the skills of critical analysis to examine environmental issues which contain differences in fact, theory and opposing views.
   b. differentiation among ideas about the causes of environmental problems through time.

3. a. discussion and critique of the law of uniformitarianism as it relates to environmental science
   b. explanation of the principle of mass balance and conservation.
   c. explanation of the hydrologic cycle, global water balance and global weather and climate patterns.
   d. explanation of the principles of energy consumption and the global energy balance.
   e. description of the major ecosystems and how they function and change.

4. a. identification of environmental problems in different countries and speculation about how different cultures approach environmental problems especially in Zimbabwe, Thailand, and Sweden.
   b. formulate hypotheses about environmental perception and test these through surveys.
General Studies Proposal Form, page 2

5. a. use of topographic, land use, zoning, and geologic maps and research reports to select the best location for a solid waste site and test the decision making process through a computer model demonstration.

6. As students learn about the greenhouse effect and global warming, they will also learn that predictions have been made using the same information for global cooling. Students will examine controversial predictions about urban micro climate change, global climate change and ice cap melting and sea level rise.

II. If the proposed course is for Level II, specify how the relevant general criteria for Level II courses will be met.

A. 1. Students are introduced to the terms of environmental science and concepts used in geographic analysis.

2. Materials are incorporated into the lecture that covers the history of the conservation and environmental movements in the U.S.

3. The development of theories and concepts in environmental science are covered.

4. The relationship of environmental science to other disciplines is evident in the outline. It includes material from geography, geology, biology, chemistry, economics, political science, and urban and regional planning.

5. The influence of technological change is a recurring theme throughout the course. What is considered a resource, and how resources are extracted is directly related to technological change. The relationship of technological change and the level of economic development to environmental degradation are examined in a variety of contexts.

6. Ethics and values are discussed as students learn about environmental problems in other countries and compare them to the U.S. These are further explored through case studies and a debate. This is also related to how humans respond to a changing local, regional, and global physical environment.

B. 1. Students will demonstrate effective communication and writing skills through group discussion, oral presentation, research paper and a 10-page report.

2. Students will evaluate alternate locations for a solid waste disposal site. After a location is selected, they will check out their decision making process through a computer modeling experience.

3. Students will locate, organize and evaluate materials for the research paper. They will also be encouraged to conduct interviews with local environmental professionals.

4. Students will either be involved in field exercises or case studies on waste management, and air and water quality.

5. A student will prepare, conduct and analyze a pre- and post-survey on environmental perception.

APPROVALS:

[Signatures and dates]

Vice President for Academic Affairs