

Course Outline for GEOL 7

ENVIRONMENTAL GEOLOGY: RESOURCES, USE IMPACT & POLLUTION

Effective: Fall 2010

I. CATALOG DESCRIPTION:

GEOL 7 — ENVIRONMENTAL GEOLOGY: RESOURCES, USE IMPACT & POLLUTION — 3.00 units

Understanding how and where Earth's environmental resources are created and located, and then studying how the resources are accessed and utilized. Topics include rock and mineral resources, energy resources (including fossil fuel and non-fossil fuel resources), water (including rivers, reservoirs, groundwater, etc.), waste disposal (including water and air pollution), global climate changes (including the greenhouse effect), etc. 3 hours lecture.

3.00 Units Lecture

Grading Methods:

Pass/No Pass

Discipline:

	MIN
Lecture Hours:	54.00
Total Hours:	54.00

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: 1

III. PREREQUISITE AND/OR ADVISORY SKILLS:

IV. MEASURABLE OBJECTIVES:

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

1. explain the scientific method; and to be able to differentiate facts from theories;
2. discuss the common theories regarding the formation of the Earth, its atmosphere, oceans and internal layers;
3. analyze and discuss the evidence for Plate Tectonics and to apply plate tectonics to the interpretation and analysis of basic geologic features
4. explain what minerals are and how they are formed;
5. categorize the three basic rock groups and the common rock types in each group; to explain their origin and classification system;
6. demonstrate a knowledge of the Geologic Time Scale, to describe the fossil record and to explain radiometric dating and to calculate geologic ages;
7. explain the basics of stratigraphy and to analyze relative age-dating geologic configurations;
8. identify and explain the basics of structural geology; including folds and faults and their relationships to plate tectonics;
9. describe and explain economic rock and mineral deposits and how they are mined; to analyze and evaluate what the impacts are and to assess and appraise what the alternatives are;
10. explain, analyze and evaluate the Earth's energy resources; how they are formed and/or accessed, the mining and use impacts, pros, cons and alternatives; including traditional fossil fuels as well as non-fossil fuel sources;
11. explain, discuss and evaluate the fundamentals of river systems and river water resources, including water, transport, waste disposal, energy sources, floodplain nutrients, etc.;
12. explain and discuss the fundamentals of groundwater resources and to explain and analyze how they are accessed and utilized, as well as to evaluate the environmental impacts and future outlook;
13. discuss, explain, compare and evaluate the typical types/methods of waste disposal including landfills, rivers, groundwater, oceans, atmosphere, etc.

V. CONTENT:

A. Geologic Time

1. Eons, Eras and Periods
2. What geologic event occurred at the beginning/end of each Eon and Era
3. Radiometric Age Dating
 - a. Radioactive decay and half-lives
4. Formation of the Solar System and Earth
5. Basic Fossil Record Through Time (trace fossils, Cambrian explosion, Age of Invertebrates, Age of Fishes, Age of Amphibians, Age of Reptiles (including dinosaurs), Age of Mammals, etc.)

B. Plate Tectonics

1. Evidence for, and evolution of, Plate Tectonic Theory
2. Impact of Plate Tectonic Theory to the fundamentals of global geologic interpretations
 - a. Three Types of Plate Edges and their geologic features: volcanoes, earthquakes, etc.
 - b. Hot Spots

C. Minerals

1. What are Minerals?
2. How do Minerals Form?
- D. Basic Rock Types and Processes
 1. The Rock Cycle
 2. Igneous rocks and igneous activity
 - a. Basic igneous rock types
 - b. Where and how these rocks are formed
 3. Sedimentary rocks and their deposition
 - a. Basic Types of Sedimentary Rocks
 - b. Stratigraphy
 1. Relative Age Dating
 4. Metamorphism and metamorphic rocks
 - a. Basic Types of Metamorphic Rocks
 - b. Where and how metamorphic rocks form
 5. Structural Geology
 - a. Folds and Faults
 - b. Understanding Geologic Maps
- E. Economic Rock and Mineral Deposits
 1. How they are formed and where they are found
 2. How they are accessed and mined
 3. Environmental impacts of mining
 4. Alternative mining methods and alternative use possibilities
- F. Energy Resources
 1. How they are formed and where they are found
 2. How they are accessed and utilized
 3. Environmental impacts of access, mining and utilization (including pollution)
 4. Traditional Fossil Fuels
 5. Alternatives to Fossil Fuels
 6. Pros and Cons of each type of energy resource
- G. Water Resources and Usage Impacts
 1. The Hydrologic Cycle
 2. River Systems
 - a. River Resources
 1. Rivers as water sources
 2. Rivers as transport systems
 3. Rivers as waste systems
 4. Rivers as energy resources
 5. Rivers as floodplain nutrient sources
 3. Groundwater
 - a. Basic Groundwater Features and Processes
 - b. Aquifers and Aquicludes
 - c. Artesian Wells and Aquifers
 - d. Environmental Issues
 1. Cone of depression
 2. Ground subsidence
 3. Saltwater encroachment (intrusion)
 4. Groundwater contamination (landfills, septic tanks, etc.)
- H. Waste Disposal & Pollution
 1. Into landfills, rivers, groundwater, ocean, the atmosphere, etc.
 2. Understanding the natural systems and what happens to the waste after it enters the systems
 - a. Greenhouse gases
 - b. Global Climate Change
 3. Understanding commonly used methods, practices and alternatives

VI. METHODS OF INSTRUCTION:

- A. **Lecture** -
- B. **Discussion** -
- C. CD-ROM images and animations
- D. Textbook and textbook CD-ROM
- E. **Demonstration** -
- F. Video clips
- G. Internet
- H. 35mm and Powerpoint slides

VII. TYPICAL ASSIGNMENTS:

- A. Write a paper that lists and explains the pros and cons of each of the major energy resources.
- B. Read the chapter on Groundwater and answer the questions at the end of the chapter.
- C. Complete the Study Guide questions for Exam 2.
- D. Read Chapter 15 in the textbook.
 1. Look up all vocabulary for this chapter.
 2. Learn to identify the geomorphic features in this chapter in satellite images and regular aerial and ground photos.
 3. Make sure that you understand the basic geologic processes discussed in this Chapter.
 4. Complete the questions in the Study Guide that refer to the topics in this chapter.
- E. Research Paper. Submit a 5-10 page 12-point paper on a geologic topic approved by the instructor.
- F. Presentation. Create and present a 5-10 minute presentation on a geologic topic approved by the instructor.

VIII. EVALUATION:

A. **Methods**

1. Home Work
2. Other:
 - a. Quizzes and Midterms— includes short answer, multiple choice, and essay questions; includes geologic interpretation of satellite, aerial and standard photos, identification and interpretation of geologic features from geomorphic maps
 - b. On-Line Quizzes and/or Essays – may use the textbook website quizzes and/or Blackboard Quizzes – online quizzes are at the discretion of the instructor
 - c. Term Paper or Student Presentations (instructor's option)
 - d. Discussion Board and/or other types of online assignment

B. **Frequency**

1. Homework can be assigned daily, weekly or all at the beginning of the term or only as needed, at the discretion of the instructor
2. Quizzes will be given daily, weekly, bi-weekly or at the discretion of the instructor
3. Quizzes/Midterms/Final Exam/Term Paper – at least 3 or 4 total. For example, there may be 2 midterms, one final exam and one term paper. Or, there may be 4 on-line quizzes, 3 in-class midterms and one in-class final exam.

IX. TYPICAL TEXTS:

1. Blatt, H (1998). *Laboratory Exercises in Environmental Geology* (2nd ed.). Columbus, Ohio: Mc-Graw-Hill Publishers.
2. Keller, E (2008). *Introduction to Environmental Geology – with CD* (4th ed.). Upper Saddle River, New Jersey: Prentice-Hall Publishers.
3. Montgomery, C.W (2008). *Environmental Geology* (8th ed.). San Francisco, California: WCB McGraw-Hill Publishers.
4. Tarbuck, E.J. and Lutgens, F.K. (2008). *Earth, An Introduction to Physical Geology*, (9th ed.). Upper Saddle River, New Jersey: Prentice-Hall Publishers, .

X. OTHER MATERIALS REQUIRED OF STUDENTS:

- A. Access to the internet and computers, through the LPC Computer Center, or access to a personal computer at home with an internet connection
- B. A small booklight for taking notes while satellite and slides are discussed in class
- C. A set of colored pencils
- D. Study guides as made available by the instructor