

## **Earth Resources**

**Instructor:** Dr. Michael Bizimis  
Associate Professor,  
University of South Carolina,  
School of Earth Ocean and the Environment.  
[mbizimis@geol.sc.edu](mailto:mbizimis@geol.sc.edu)  
<http://www.seoe.sc.edu/mbizimis>

### **Course Description:**

At the most basic level, every resource we use as a civilization comes from the Earth. Water, Oil, Metals, Rocks, precious Minerals, all come from the Earth. Understanding how a resource is created and distributed globally is, therefore, a fundamental underpinning of resource management, global economics, and geopolitics.

The course introduces the basic principles and fundamentals of geology. It will provide a broad overview of mineral, energy, and water resources, their formation, distribution and the impacts of resource use on the environment and society. Emphasis will be placed on the geological processes governing resource formation and distribution, and the geopolitics related to their use.

Some of the subjects to be covered:

- What is a Resource?
- Basic geological processes and fundamentals of Geology.
- Earth formation: All resources we use come from the Earth.
- Rock, carbon, and water cycles.
- Mineral resources: Geological formation, global distribution, usage and environmental impacts of exploration and use.
- Energy resources: Fossil fuels (oil, natural gas, coal), Nuclear, Renewable energy sources; Environmental impacts of different energy source usage.
- Water resources, pollution, and remediation.
- Climate change.

The central goal of this course is for the student to become a better-informed citizen on how different resources are formed and the impact of their use on the environment, so as to become a better future manager of these resources.

### **Course credit:**

This course is intended for undergraduate students seeking the equivalent of 3 units (US) of 4.5 ECTS credits (Europe) that typically cover a general science requirement for their course work, or for those who wish to gain a better understanding of how the Earth works and how resources are formed in the context of a global society.

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### **Learning Outcomes:**

Upon the completion of this course the student will:

- Understand and explain the fundamentals of plate tectonics, rock, carbon and water cycles.
- Understand and explain how fundamental geological, physical and chemical processes form usable resources (minerals, metals, hydrocarbons, drinking water).
- Use basic geology principles to develop first order hypotheses on the location and distribution of specific natural resources (for example oil or copper deposits) on the planet.
- Understand and explain how changes in societal needs (for example population growth, affluence and technology) change the use and needs for different natural resources and energy.
- Understand and explain the environmental and societal impacts of mineral resource use, and possible means of remediation for varying types of pollution as related to earth resource use.
- Evaluate and compare the pros and cons of the different types of energy generation, including their impacts (positive and negative) on the environment and society.
- Understand and explain the natural processes that form fresh water resources and how increased demand can impact inexpensive access to fresh water.
- In the most fundamental way, the student will learn how to apply the principles of Geology and Earth Sciences to understand the formation, usage and future availability of natural resources in an ever changing society, and to formulate basic hypotheses, evaluate data and develop defensible conclusions related to the use of natural resources and energy.

### **Course materials:**

Reading materials in the form of PDF files will be provided to the students by the instructor before the classes (either through Google Drive or other means). A textbook is not required, but the textbook ***Environmental Geology*** by Carla W. Montgomery, McGraw-Hill, is a useful read for more in depth coverage (various versions between 2009 and 2014 are fine, digital or book versions are fine). If students opt to buy this book, they should do so prior to coming to Greece.

A laptop computer or tablet with the ability to read PDF files is required in the class and for after class reading.

### **Schedule:**

This is a two-week course, based on 10 4-hour lectures (total of 40 contact Instructor – student hours). Classes will be held Monday through Friday (meeting time TBD).

### **Tentative Lecture Schedule, SUMMER 2017**

DAY 1	INTRODUCTION, BASIC SCIENTIFIC PRINCIPLES, EARTH FORMATION.
DAY 2	PLATE TECTONICS
DAY 3	MID TERM 1; ROCK CYCLE, ORE FORMATION: COPPER, ZINC, GOLD

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DAY 4	SULFIDES ,IRON, ALUMINUM
DAY 5	MIDTERM 2; PLACER DEPOSITS, ENV IMPACTS OF MINING
DAY 6	ENERGY, FOSSIL FUELS (OIL, OIL, GAS, COAL)
DAY 7	FOSSIL FUELS (OIL, OIL, GAS, COAL)
DAY 8	MID TERM 3; NUCLEAR ENERGY, RENEWABLE ENERGY SOURCES,
DAY 9	RENEWABLES, WATER RESOURCES
DAY 10	FINAL EXAM; WATER RESOURCES, CLIMATE

Depending on the pace of the class and the interests of the students, some material may move up or down the schedule or other material added / substituted.

### **Evaluation and grading policy:**

The course includes the following three means of evaluating student performance and comprehension of the material:

- There will be three (3) mid-term exams and a final exam. The exams consist of questions designed to evaluate student understanding of the basic terminology and principles covered in the lectures. Those exams will take ~40 minutes at the beginning of a class session. NOTE: The lowest grade of the three (3) mid term exams will be dropped from your overall grade calculation. Each of the highest two (2) midterms are worth 20 points and the final exam will be worth 25 points, for a total of 65 points.
- There will be a series of unannounced in-class quizzes / questions. These questions / quizzes are simple (~ 2-3 minute questions) designed to simulate the scientific method of inquiry, hypothesis, data collection and conclusion. These quizzes / questions will be based on concepts presented in the class during the lecture, and the students will be asked to formulate hypotheses, present scientific facts in a logical manner and / or reach conclusions based on available data / facts. The quizzes / questions are also a way of judging student participation, material comprehension and attendance. The quizzes will be worth a total of 20 points of your grade.
- There will be one paper project (~ 1500 words total). The students are asked to discuss a subject related to a resource use and its relationship to societal or environmental issues. The paper should present facts in a logical manner, a discussion of the problem / issue and discuss solutions that you think are possible. A series of topics will be suggested in class, but students are encouraged to select a project of their choice, in consultation with the instructor. The paper is worth 15 points, and it is due 1 month after the end of the course.

### Grading summary:

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| • 3 Midterm exams (lowest score of the three is dropped),<br>so 2 midterms x 20% | <b>40 points</b> |
| • Final Exam   | <b>25 points</b> |
| • Class quizzes / questions  | <b>20 points</b> |
| • Paper  | <b>15 points</b> |
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Total

**100 points**

Letter grading:  
90 or more = A  
87 or more = B+  
80 or more = B  
77 or more = C+  
70 or more = C  
55 or more = D  
Below 55% = F