

## **Historical Geology**

### **COURSE OUTLINE**

**Course Prefix and Number:**

**GOL 106 Credits: 4**

#### **Course Description**

Traces the evolution of the earth and life through time. Presents scientific theories of the origin of the earth and life and interprets rock and fossil record.

Prerequisite: GOL 105 or equivalent.

Lecture 3 hours. Laboratory 3 hours. Total 6 hours per week.

#### **General Course Purpose:**

GOL 106 is designed to assist students in understanding the history and evolution of their physical and natural world. Students enhance their observational and critical thinking skills through the analysis and interpretation of physical and graphical data. This course covers the origins of the solar system and evolution of Earth's structure, the relationship between life and surface conditions, and the types of life that have inhabited Earth in the past.

#### **Course Prerequisites:**

None

#### **Student Learning Outcomes:**

Upon completing the course, the student will be able to

- Quantitative Literacy
  1. Use stratigraphic and radiometric dating techniques to establish the age (or relative age) of geologic events and the formation of rocks.
- Scientific Literacy
  1. Explain the development and dynamic nature of the geologic time scale.

- **Civic Engagement**

1. Recognize and identify important marine and terrestrial sedimentary environments.

- **Critical Thinking**

1. Explain the importance of fossils in determining sedimentary environment and relative age.

- **Scientific Method**

1. Analyze the elements of the scientific method and explain how these principles apply to the study of the Earth.

- **Geologic Time**

1. Discuss the history, construction, and evolution of the geologic time scale.
2. Apply the theory of uniformitarianism and relative geologic dating principles including the principles of stratigraphy.
3. Apply the use of radioisotopes, half-life, and carbon dating to solve problems using absolute (numerical or radiometric) dating principles.
4. Recognize the age of Earth as well as the ages of Earth's oldest minerals, rocks, and fossils.

- **Plate Tectonics**

1. Describe the formation of continental crust and the tectonic processes that modify it
2. Recognize and interpret the growth and movement of continents and the Wilson Cycle of supercontinent formation and dispersal
3. Describe and date the formation and breakup of the supercontinents of Rodinia and Pangaea

- **Evolution**

1. Describe Darwinian evolution and the basic life forms that evolved over geologic time
2. Explain the basic concepts in macroevolution and relate evidence from the fossil record to them
3. Trace the events leading to the origin of life and distinguish between their forms
4. Distinguish between common types of fossilization, including the origins of fossil fuels

- **Earth Materials**

1. Test for the physical and chemical properties of minerals, and identify the most common igneous, sedimentary and metamorphic rocks.
2. Recognize the basic Earth processes and environments of the formation of each of the three rock types

3. Identify sedimentary rock composition and inherent structures used to interpret paleoenvironments and the formation of sedimentary rocks

- **Absolute Dating**

1. Explain how radioactive isotopes are used to calculate the absolute age of igneous and metamorphic rocks
2. Calculate the age of igneous and metamorphic rocks or structures based on the percentage of remaining parent isotopes and their half-life
3. Calculate the approximate age range of sedimentary rock layers using indirect dating methods

### **Stratigraphy**

1. Identify and describe the different types of unconformities
2. Correlate rock strata at multiple outcrops using lithostratigraphic or biostratigraphy methods
3. Identify and describe marine transgressive and regressive rock sequences
4. Construct stratigraphic columns

- **Paleontology**

1. Identify and classify fossils of marine and terrestrial flora and fauna
2. Determine possible depositional environment based on fossil assemblages
3. Describe the habitat and lifestyle of fossilized organisms based on their symmetry and morphology

- **Earth Origin**

1. Discuss the processes involved in Earth formation including accretion (nebula to planet), bombardment, and formation of the Moon.

- **Early Earth**

1. Describe the formation of Earth's internal structure including differentiation, the origin of the magnetic field and the heat source of the tectonic engine.
2. Analyze competing theories on the formation of hydrologic cycle, including the atmosphere and hydrosphere.
3. Analyze competing theories on the formation of Earth's early crust, both basaltic and granitic

- **Earth and Life History**

1. Analyze and interpret the rock and fossil record using uniformitarian principles to understand how the Earth and its inhabitants have evolved through geologic time.

- **Climate Change**

1. Describe the patterns and extremes of climate change in Earth's past and the probable causes
2. Explain the role of the carbon cycle in Earth's global climate
3. Discuss present understanding and predictions of future climate change due to anthropogenic activities based on the rock, fossil, and ice core record

- **General Skills**

1. Use and identify Earth Materials such as Minerals, rocks, and sediments to determine depositional environments.
2. Utilize Topographic maps and Google Earth for analysis and interpretation
3. Conduct Field Study to determine natural and human environmental issues
4. Utilize field methods and equipment for water, soil quality, mapping, sample collection
5. Write formal field and lab reports

- **Geologic Maps**

1. Utilize geologic maps to identify geologic structures and systems of rocks
2. Identify the geologic provinces of Virginia
3. Describe the orientation and geologic settings for geologic structures and outcrops
4. Use strike and dip symbols to identify the orientation and extent of geologic structures and faults

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