

Miami-Dade College

Common Course Number: GLY 3884

Course Title: Environmental Geology

Catalog Course Description: This course focuses on the study of the application of geology to the interactions between people and their physical environment. Earth materials and processes are presented in reference to hazards and concerns that are created naturally and/or by human activities. The role of humans as geologic agents, resource conservation, ecosystem management, and the problems that result from upsetting the established equilibria of geologic systems are illustrated.

Prerequisite: GLY1010

Co-requisites: GLY 3384L

Credit Hours Breakdown: 3 lecture hours

Course Competencies:

Competency 1: The student will demonstrate a basic knowledge of the origin and evolution of the Earth and its planetary environment.

Upon successful completion of this course, the student will demonstrate a basic knowledge of the origin and evolution of the Earth and its planetary environment by:

- A. Explaining the Nebular hypothesis on the origin of our Solar System and the Earth.
- B. Discussing the origin of the Earth's life-support systems and differentiating the lithosphere, atmosphere, and hydrosphere.
- C. Diagramming the internal structure of the Earth in terms of chemical layers and physical layers.
- D. Describing the effects of solar energy on Earth's surface and the sources of Earth's internal heat.
- E. Discussing heat flow, and applying the effects of heat on geological processes.
- F. Describing and inter-relating the Earth's cycles: rock cycle, hydrologic cycle, carbon cycle, nitrogen cycle, phosphorus cycle, and sulfur cycle.

Competency 2: The student will demonstrate a basic understanding of the nature and rate of human population growth.

Upon successful completion of this course, the student will demonstrate a basic understanding of the nature and rate of human population growth by:

- A. Discussing growth rate and doubling time.
- B. Analyzing the causes and consequences of population growth rate.
- C. Analyzing the impacts of the human population on: farmland and food supply, population and nonfood resources, uneven distribution of people and resources, and disruption of natural systems.

Competency 3: The student will demonstrate knowledge of basic chemistry and Earth materials.

Upon successful completion of this course, the student will demonstrate basic knowledge of chemistry and Earth materials by:

- A. Defining atom, element, isotope, ion, compound, mineral, and rock.
- B. Explaining basic atomic structure and chemical bonding.
- C. Defining and identifying the physical properties of minerals.
- D. Distinguishing between silicate and non-silicate minerals.
- E. Defining and distinguishing between igneous, sedimentary, and metamorphic rocks.
- F. Drawing and explaining the rock cycle.

Competency 4: The student will demonstrate knowledge of Plate Tectonic Theory, related internal geological processes, and associated surface landforms.

Upon successful completion of this course, the student will demonstrate knowledge of Plate Tectonic Theory, related internal geological processes, and associated surface landforms by:

- A. Discussing the dynamic interaction between the Earth's lithosphere and asthenosphere.
- B. Comparing and contrasting the three types of plate boundaries and the motion occurring at each type

- C. Analyzing the geological processes occurring at each type of plate boundary.
- D. Explain the surface landforms resulting from geological processes at each type of boundary

Competency 5: The student will demonstrate knowledge of seismic activity and the hazards it poses to human populations.

Upon successful completion of this course, the student will demonstrate knowledge of seismic activity and the hazards it poses to human populations by:

- A. Defining related vocabulary including earthquake, fault, seismic energy, focus, epicenter, magnitude, intensity, and seismology.
- B. Comparing the types of seismic energy waves and ground motion associated with each aspect.
- C. Locating and describing the major earthquake belts of the Earth and U.S. areas of widely recognized risk.
- D. Evaluating earthquake-related hazards and methods for their reduction: ground shaking, fire, tsunamis, coastal subsidence and flooding, coastal uplift.
- E. Discussing earthquake prediction and forecasting.
- F. Analyzing proposed methods for earthquake control.
- G. Discussing earthquake awareness and concerns related to predictions.

Competency 6: The student will demonstrate knowledge of volcanic activity and the hazards it poses to human populations.

Upon successful completion of this course, the student will demonstrate knowledge of volcanic activity and the hazards it poses to human populations by:

- A. Defining related vocabulary including volcano, magma, lava, vulcanology, geyser, hot spring, fumarole, laccolith, batholith, pluton.
- B. Comparing the types and locations of volcanic activity including mid-ocean ridges and rises, fissure, eruptions, vent eruptions, hot spots.
- C. Classifying volcanoes by structure and activity.
- D. Describing and analyzing the primary and secondary effects of volcanic hazards.
- E. Discussing issues in predicting volcanic eruptions.

- F. Analyzing present and future volcanic hazards in the U.S.: Hawaii, The Cascade Range, The Aleutian Islands, Mammoth Lakes/Long Valley Caldera, and Yellowstone National Park.

Competency 7: The student will demonstrate knowledge of Earth's surface processes and the hazards they pose to human populations.

Upon successful completion of this course, the student will demonstrate knowledge of Earth's surface processes and the hazards they pose to human populations by:

- A. Defining: reservoir, residence time, stream, stream channel, drainage basin, tributary, distributary, floodplain, stream stage, stream discharge, stream velocity, stream gradient, base level, and sediment transport.
 - B. Diagramming the Hydrologic Cycle.
 - C. Listing, defining, and describing the seven processes that comprise the Hydrologic Cycle.
 - D. Comparing the three types of sediment transport and sorting by streams: suspended load, dissolved load, and bedload.
 - E. Describing floodplain evolution in terms of three stages: early, middle, and late.
 - F. Distinguishing between and defining the characteristics of a slow rising flood and a flash flood.
 - G. Evaluating the consequences of development in floodplains and the effects of development on flood hazards.
 - H. Analyzing strategies for reducing flood hazards.
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- A. Recognizing coastal hazards.
 - B. Distinguishing between emergent and submergent shorelines.
 - C. Describing coastal erosion and coastal sediment transport and deposition.
 - D. Evaluating the difficulties and problems surrounding land reclamation from estuaries.
 - E. Comparing and contrasting the difficult coastal environments: barrier islands and estuaries.
 - F. Analyzing coastal dynamics and hazards in terms of present and future sea level fluctuations, storms and coastal erosion, and the costs of construction and reconstruction in high-energy coastal environments.

- A. Defining the types of mass movements: fall, slide, slump, flows, and avalanches.
 - B. Listing and describing the factors affecting slope stability: gravity, water, vegetation, earthquakes, and quick clays.
 - C. Evaluating the rates and scales of mass movements.
 - D. Examining slope hazards and the impacts and consequences of human activities on slope stability.
 - E. Comparing and contrasting possible preventive measures for stabilizing slopes.
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- A. Listing and describing the types of glaciers.
 - B. Describing glacial formation and movement.
 - C. Describing glacial erosion and deposition and classifying associated glacial features.
 - D. Predicting evidence of past climates and discussing Ice Ages and their possible causes.
 - E. Discussing wind and its geological impacts on human populations.
 - F. Evaluating the causes of natural deserts.
 - G. Examining the human-induced process of desertification, its causes, and impacts in the United States and globally.
 - H. Summarizing the causes and effects of the Greenhouse Effect and global warming.

Competency 8: The student will identify Earth's natural resources and their importance to human populations.

Upon successful completion of this course, the student will identify Earth's natural resources and their importance to human population by:

- A. Distinguishing between surface water resources and groundwater resources.
- B. Comparing confined and unconfined aquifers.
- C. Evaluating consequences of groundwater withdrawal.
- D. Evaluating the impacts of urbanization on groundwater systems.

- E. Identifying landform features associated with subsurface water.
- F. Analyzing measures of water quality, water supply and water use in the United States.
- G. Discussing methods of extending the water supply.

- A. Discussing weathering and soil-forming processes.
- B. Drawing a soil profile and the soil horizons.
- C. Discussing soil quality and soil fertility.
- D. Evaluating the impacts of human activities on soils.

- A. Defining ore deposits and discussing their distribution.
- B. Classifying types of mineral deposits.
- C. Giving examples of mineral and rock resources.
- D. Evaluating mineral supply and demand in the United States and worldwide.
- E. Analyzing future mineral resource options.
- F. Discussing the impacts of mining activities.

- A. Describing the formation of oil and natural gas and their supply and demand.
- B. Evaluating the environmental hazards associated with oil spills.
- C. Discussing the formation of coal deposits, coal reserves and resources, and the limitations on coal use.
- D. Analyzing the environmental impacts of coal use: sulfur in coal, ash, and mining hazards.
- E. Discussing nuclear fission and fusion as sources of energy.
- F. Examining solar heating, solar electricity, and the potential environmental impacts of large-scale commitment to solar electricity.
- G. Examining geothermal energy, geothermal resources, and applications of geothermal energy.
- G. Evaluating alternative energy sources including hydropower, tidal power, wind energy, and biomass.

Competency 9: The student will demonstrate knowledge of waste disposal and pollution.

Upon successful completion of this course, the student will demonstrate knowledge of waste disposal and pollution by:

- A. Listing the various types of solid waste.
 - B. Discussing municipal waste disposal.
 - C. Evaluating waste handling and methods for reducing solid waste volume.
 - D. Explaining liquid waste disposal.
 - E. Examining sewage treatment methodology: septic systems and municipal sewage treatment.
 - F. Analyzing the nature and disposal of radioactive waste.
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- A. Relating general principles involving water and pollution.
 - B. Describing and discuss industrial pollution including inorganic, organic and thermal pollution and problems in pollution control.
 - C. Evaluating the nature and impacts of organic matter.
 - D. Discussing agricultural pollution: fertilizers, barnyard waste, sediment pollution, herbicides and pesticides.
 - E. Comparing and contrasting methods for reversing surface water pollution: dredging, physical isolation or chemical treatment of sediments and aeration decontamination processes.
 - F. Analyzing methods for reversing groundwater pollution: the surface-groundwater connection, *in situ* decontamination and decontamination after extraction.
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- A. Describing atmospheric chemistry, cycles, and residence times.
 - B. Analyzing costs of air pollution.
 - C. Evaluating types and sources of air pollution.
 - D. Illustrating the nature of acid rain and the regional variations in rainfall acidity.

- E. Relating air pollution and weather: thermal inversion and impacts on precipitation.
- F. Evaluating air quality standards and methods of air pollution control.

Competency 10 (Optional): The student will demonstrate knowledge of medical geology.

Upon successful completion of this course, the student will demonstrate knowledge of medical geology by:

- A. Describing basic principles of medical geology such as dose-response curves.
- B. Relating the geology of trace elements to human health:
 - 1. controls on elemental intake: Iodine, Fluorine, Zinc, Selenium and Radon
 - 2. cases in which connections are less clear:
 - a. radioactivity and cigarettes.
 - b. regional variations in heart disease.
 - c. other intriguing patterns: correlations between soil chemistry, soil distribution, and cancers.
 - 3. further complicating factors:
 - a. cause and effect or coincidence.
 - b. trace element interactions.
 - c. impacts of human activities.