Montgomery County Community College
GLG 115
Environmental Geology
4-3-3

COURSE DESCRIPTION:
Environmental Geology is an examination of geologic processes which have impact upon humans and of the impact humans have upon those processes. Topics such as coastal erosion, flooding, earthquakes, radon, greenhouse effect, water quality, and waste disposal will be investigated. Environmental Geology should be considered by the following students: those needing a lab-science elective, those preparing for a career as an environmental technician, and those considering a Geology major seeking a geology elective. Class time and Saturday field trips will be taken. This course is subject to a course fee. Refer to http://mc3.edu/adm-fin-aid/paying/tuition/course-fees for current rates.

REQUISITES:
*Previous Course Requirements*
- Math 011 Beginning Algebra or MAT 011B Beginning Algebra with Review of Arithmetic

*Concurrent Course Requirements*
None

| LEARNING OUTCOMES Upon successful completion of this course, the student will be able to: | LEARNING ACTIVITIES | EVALUATION METHODS |
|---|---|---|
| 1. Apply the scientific method of inquiry. | Lecture<br>Laboratory Procedures<br>Computer-Aided Instruction<br>Text and Outside Readings | Assessment of Laboratories<br>Exams |
| 2. Utilize an understanding of dynamic geologic systems to recognize their potential hazards (e.g., volcanoes, earthquakes, floods, coastal storms, etc.). | Lecture<br>Laboratory Procedures<br>Computer Simulation<br>Computer-Aided Instruction<br>AV/Multimedia Materials<br>Text and Outside Readings<br>Saturday Field Trips<br>Unit Examinations | Assessment of Laboratories<br>Exams<br>Quizzes |

| LEARNING OUTCOMES | LEARNING ACTIVITIES | EVALUATION METHODS |
|---|---|---|
| 3. Recognize how human activities have impacts upon natural geologic systems. | Lecture<br>Laboratory Procedures<br>Computer Simulation<br>Computer-Aided Instruction<br>AV/Multimedia Materials<br>Text and Outside Readings<br>Class Time and Saturday<br>Field Trips<br>Unit Examinations<br>Projects | Group/Individual Projects<br>Exams<br>Laboratory Assessments<br>Quizzes |
| 4. Recognize problems and envision solutions for remediation of disrupted geologic systems. | Lecture<br>Small Group Discussion<br>Laboratory Procedures<br>Computer Simulation<br>Computer-Aided Instruction<br>AV/Multimedia Materials<br>Text and Outside Readings<br>Class Time and Saturday<br>Field Trips<br>Unit Examinations<br>Projects | Group/Individual Projects<br>Exams<br>Laboratory Assessments<br>Quizzes |

At the conclusion of each semester/session, assessment of the learning outcomes will be completed by course faculty using the listed evaluation method(s). Aggregated results will be submitted to the Associate Vice President of Academic Affairs. The benchmark for each learning outcome is that *70% of students will meet or exceed outcome criteria*.

SEQUENCE OF TOPICS:

1. Introductory Fundamentals
    a. Scientific Method
    b. Exponential Growth
    c. Fundamental Chemistry Concepts
2. Geological Fundamentals
    a. Silicates
        1) Introduction to silicate structural chemistry
        2) Case history – the asbestos problem
            a) mineralogy of asbestiform silicates
            b) commercial asbestos utilization
            c) asbestos-related disease
    b. Common Rocks
        1) Introduction to common crustal rocks
        2) Case history – the household radon problem
            a) geology/geochemistry of uranium occurrences
            b) secular and synoptic variability
            c) radon-related disease
            d) hazard analysis/risk assessment
    c. Topographic Maps

- d. Plate Tectonics

3. Internal Processes Which Have Impact Upon Humans
   - a. Earthquakes
     - 1) Tectonic processes
     - 2) Earthquake detection and seismological interpretation
     - 3) Probabilistic analysis of earthquake risks
   - b. Volcanic Processes
     - 1) Tectonic context
     - 2) Eruption processes and mechanics
     - 3) Volcanic hazards
4. Surficial Processes Which Have Impact Upon Humans
   - a. Mass Wasting
     - 1) Fundamentals
     - 2) Impact of development upon slope stability
     - 3) Case histories as per instructors
   - b. Streams
     - 1) Fundamentals
     - 2) Hydrographs
     - 3) Impact of development upon flood frequency and magnitude
     - 4) Case histories as per instructor
   - c. Groundwater
     - 1) Fundamentals
     - 2) Disruption by over-utilization
   - d. Water Quality
     - 1) Fundamentals
       - a) D.O., B.O.D., C.O.D.
       - b) pH
       - c) dissolved metals
       - d) suspended sediment
     - 2) Case histories – optional per instructor
       - a) Penna. coal industry
       - b) Tyson's landfill
       - c) Radioactive waste disposal
         - (1) WIPP
         - (2) Yucca Mtn – A good idea gone bad? NIMBY syndrome.
   - e. Coastal Processes
     - 1) Fundamentals
     - 2) Eustatic sea level rise
     - 3) Impact of development upon natural sediment distribution
     - 4) Case histories
5. Atmospheric And Climatological Considerations
   - a. Climate Change
     - 1) Natural greenhouse absorption spectrum
     - 2) Causes of seasonality
     - 3) Milankovitch forcing factors
     - 4) Quantitative paleothermometry
     - 5) Anthropogenic forcing factors
     - 6) Climate models – predicting the future
     - 7) Atmosphere-cryosphere-hydrosphere coupling

a) El Nino/La Nina: Southern Oscillation
b) Atlantic Deep Water/Salt Conveyor

b. Sea Level Change
1) Natural causes
2) Anthropogenic causes
3) Recent trends
4) Implications
a) climate feedback
b) direct human impacts

c. Stratospheric Ozone
1) Natural ozone-production stoichiometry
2) Stratospheric ozone degradation
3) Commercial uses and sources of ozone degraders
4) Montreal Protocol, London Amendments, Clean Air Act
5) Kyoto Protocol

LABORATORIES – to be selected by the instructor. Others may be added at the discretion of the instructor.

1. Mineral properties, Uses and Identification
2. Igneous, Sedimentary, Metamorphic Rocks rocks
3. Topographic maps
4. Geologic maps
5. Plate tectonics
6. Volcanoes – hazard determination from geologic maps
7. Earthquakes –determination of an epicenter
8. Karst topography, subsidence hazards, and slope stability
9. Running water and groundwater
10. Steam hydrographs – the statistics of stream flow
11. Hydrology – porosity and permeability determinations
– ascertaining groundwater flow dynamics
12. Radon testing and interpretation
13. Waves, currents and tides

FIELD TRIPS Optional

In-class trips at the discretion of the instructor:

1. Assessment of landslide potential
2. Towamencin Creek Field Project
3. Stream profiling

Optional Saturday field trips:

1. Traverse from Cape Henlopen to South Bethany, Delaware
– determination of natural erosional/depositional dynamics
– examination of development and associated disruption of coastal dynamics
2. The geology of coal – Southern and Western Middle Anthracite Fields, Pennsylvania
– strip mined properties: pre- and post-reclamation legislation extraction techniques
– geological/biological recovery at abused sites
– culm recovery
– Centralia mine fire
– geology, chemistry, and biology of acid mine drainage

3. Ringing Rocks Park, Upper Black Eddy, PA – igneous rock erosional features
4. Pioneer Crossing Landfill, Birdsboro, PA – engineering protection of the environment; waste disposal
5. Crystal Cave, Kutztown, PA – karst terrain; speleothem formation

LEARNING MATERIALS:
Keller, Edward. (2012). *Introduction to Environmental Geology (*5th ed.). Pearson/ Prentice Hall.
Optional: McPhee, John. (1989). *The Control of Nature*. Noonday Press.
Optional: *Earth Sciences Laboratory Manual*, current edition
Supplementary Handouts
College Computer Network
Tutorial Services

Other learning materials may be required and made available directly to the student and/or via the College's Libraries and/or course management system.

COURSE APPROVAL:

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|---|---|---|
| Prepared by: | Robert Kuhlman, Professor of Earth Science | Date: 10/28/2004 |
| Revised by: | George Buchanan, Asst. Professor of Geology | Date: 5/24/2013 |
| VPAA/Provost or designee Compliance Verification: | | |
| | Victoria L. Bastecki-Perez, Ed.D. | Date: 6/10/2013 |
| Revised by: | Debbie Dalrymple | Date: 6/27/2016 |
| VPAA/Provost or designee Compliance Verification: | | |
| | Victoria L. Bastecki-Perez, Ed.D. | Date: 6/27/2016 |
| Revised by: | Debbie Dalrymple and Evon Martins | Date: 1/11/2018 |
| VPAA/Provost or designee Compliance Verification: | | Date: 1/30/2018 |

*This course is consistent with Montgomery County Community College's mission. It was developed, approved and will be delivered in full compliance with the policies and procedures established by the College.*