Ohio Articulation Number (OAN)  
Course Submission Form  
2005-2006

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<th>College/University</th>
<th>Cuyahoga Community College</th>
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<tr>
<td>Course(s) Submitted</td>
<td>Physical Geology, ESCI – 1410 for OSC011</td>
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<tr>
<td>Date</td>
<td>June 7, 2006</td>
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<td>Course</td>
<td>1 of 2</td>
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<thead>
<tr>
<th>Name and title of individual submitting on behalf of the college/university</th>
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<tbody>
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<td>Name</td>
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| Credit Hours | 3 | qtr | sem x |
| Lecture Hours | 3 |
| Laboratory Hours | 0 (if applicable) |
| Pre-Requisites(s) Course work (if applicable) | None |

Placement Score (if applicable) (Name of test) (Domain) (Score)
**Catalog/Course Description (Includes Course Title and Course #)**

<table>
<thead>
<tr>
<th>Fall 2005- Summer 2007/Physical Geology, ESCI-1410</th>
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<tbody>
<tr>
<td>Topics include materials and structures of the Earth; processes and agencies which change the Earth’s crust. Mineral composition of rocks; work of gravity, water, winds, and glaciers as agents of erosion; and volcanoes and earthquakes as forces which change the Earth’s surface. To fulfill laboratory science requirements, students should also enroll in related laboratory course.</td>
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**Texts/Outside Readings/Ancillary Materials**

See Course Outline

Course Objectives and/or Plan of Work

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**CUYAHOGA COMMUNITY COLLEGE**  
**OFFICIAL COURSE OUTLINE**

<table>
<thead>
<tr>
<th>SUBJECT AREA TITLE</th>
<th>Earth Science</th>
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<tbody>
<tr>
<td>COURSE TITLE</td>
<td>Physical Geology</td>
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<tr>
<td>SUBJECT AREA CODE-COURSE NUMBER</td>
<td>ESCI - 1410</td>
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<td>COURSE CREDIT HOURS</td>
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**I. DESCRIPTION OF COURSE:**

A. CATALOG DESCRIPTION:

Topics include materials and structures of the Earth; processes and agencies which change the Earth’s crust. Mineral composition of rocks; work of gravity, water, winds, and glaciers as agents of erosion; and volcanoes and earthquakes as forces which change the Earth’s surface. To fulfill laboratory science requirements, students should also enroll in related laboratory course.

B. LECTURE HOURS: 03

C. LABORATORY HOURS: 00
D. OTHER REQUIRED HOURS: 000

E. PREREQUISITE(S): None

II. OUTCOMES/OBJECTIVES:

Upon successful completion of ESCI-1410 Physical Geology, the student should be able to:

A. Describe the tectonic forces that produce earthquakes, volcanism, and related phenomena.
B. Describe the atomic structure of minerals and know of their occurrences and economic uses.
C. Describe the formation of, locations of, and structures of igneous, sedimentary, and metamorphic rocks and the methods used to identifying them.
D. Explain development of major landforms and recognize and discuss the actions and interactions of gravity, water, ice, and wind on the earth's surface.
E. List the components and dates of the geologic column.
F. Differentiate between relative and absolute dating and explain the methods used in both processes.
G. Differentiate between chemical and physical weathering and explain the different processes of each of these.
H. Explain the various types of mass wasting.
I. Differentiate between erosional and depositional processes and features of gravity, water, wind and ice.
J. Differentiate between P, S, and L seismic waves and explain how they are measured and their implications.
K. Describe the features of the ocean floor and how they change over time.
L. Differentiate between plate tectonics and continental drift theories.
M. Locate plate boundaries and identify the plates and the types of boundaries that separate them.
N. Explain different methods of mountain formation.
O. List valuable geologic resources, their distributions, methods of extraction, and uses.
P. Recognize and measure geological features in the field.

III. COURSE CONTENT:
A. General introduction
   1. Outline of course
   2. Goals of the course
   3. Scientific method
   4. Concept of geologic time: catastrophism and uniformitarianism
   5. Compositions and interactions of the parts of the ecosphere:
      lithosphere; atmosphere; hydrosphere; biosphere
B. Introduction to plate tectonics
   1. Layers of the earth: crust, mantle, and core; lithosphere and
      asthenosphere
   2. Plate boundaries and their relationships to earthquakes and volcanoes:
      rift zones; subduction zones; and transform boundaries
C. Comparison of rocks and minerals
D. Atomic structure
   1. Composition of the atom
   2. Determination and significance of atomic number, atomic mass, and
      electron shells
   3. Arrangement of electrons as basis for the formation of ions
   4. Compare and contrast a cation and an anion as to change in size and
      change in number of electrons
   5. Bonding: ionic bonding; covalent bonding; metallic bonding; van der
      Waal forces
   6. Crystal structure
   7. Polymorphism and solid solutions
   8. Crustal abundance of the atoms
E. Minerals
   1. Chemical environment of formation
   2. Chemical composition and atomic structure of the silicates: isolated
      tetrahedral; single chains; double chains; sheets; frameworks
   3. Descriptions, chemistry, and uses of the mineral groups: silicates;
      carbonates; sulfates; sulfides; oxides; native elements
F. The rock cycle
   1. Magma, lava, and igneous rocks
   2. Erosion, sediments, and sedimentary rocks
   3. Heat, pressure, fluids, and metamorphic rocks
G. Volcanism
   1. Sources of heat for forming magma
   2. Types of volcanoes, their characteristics, and their occurrences: shield;
      composite/stratovolcano; cinder cones; fissure eruptions
   3. Different types of lava, their characteristics, and their occurrences:
      mafic; intermediate; felsic
   4. Extrusive rock types: pillow vs. columnar structures; aa vs. pahoehoe
   5. Correlation of volcano and lava types with plate tectonic theory
   6. Volcano prediction
   7. Recognition of extrusive igneous rocks using texture and composition
H. Intrusive igneous rocks
   1. Cooling rate and place of formation for each of the intrusive igneous rocks
   2. Correlation of intrusive igneous rock types with plate tectonics theory
   3. Recognition of intrusive igneous rocks by texture and composition
   4. Intrusive igneous bodies: concordant; discordant
   5. Processes involved with magnetic differentiation: Bowen's Reaction Series; crystal settling; assimilation; stoping

I. Weathering
   1. Concept of equilibrium
   2. Influence of climate, composition, topography, vegetation, and time
   3. Physical weathering processes: frost action; abrasion; pressure changes - exfoliation; root pressure
   4. Chemical weathering processes: solution; oxidation; hydration; hydrolysis
   5. Relations between chemical and physical processes: salt crystallization; spheroidal weathering
   6. Products of weathering
   7. Soils: horizons; types; characteristics; factors that affect soil-forming processes

J. Sedimentary rocks
   1. Types of sedimentary rocks: clastic; bioclastic; chemical precipitates - crystalline, oolitic, and amorphous
   2. Processes needed to make a sedimentary rock: transportation; deposition; preservation; lithification
   3. Textures: clastic - size and shape of particles; bioclastic; crystalline; amorphous; oolitic
   4. Environment of formation of the different sedimentary rocks
   5. Sedimentary structures and their historical geological significance: types of bedding; fossils; geodes; mud cracks; ripple marks
   6. Recognition of sedimentary rocks by texture and composition

K. Metamorphic rocks
   1. Definition of metamorphism
   2. Sites of metamorphism
   3. Types of metamorphism and relationship to plate boundaries: regional; contact
   4. Metamorphic facies as distinguished by mineral types
   5. Hydrothermal processes
   6. Recognition of metamorphic rocks by texture and composition

L. Geologic time
   1. Relative time and its determination - principles of: superposition; original lateral continuity; crosscutting relationships; inclusions
   2. Fossils and their uses in dating
   3. Absolute time and its determination: alpha decay; beta decay; beta capture; proton decay
   4. Theory of radiometric dating - half-life concept
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<th>5. Uses of and limitations of radiometric dating</th>
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<td>6. Dendrochronology and varves</td>
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<td>7. Geologic time: eons; eras; periods; epochs</td>
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**M. Mass wasting**

1. Classification of types of mass wasting: rates of movement; types of material; types of movement
2. Controlling factors of mass wasting
3. Flow movements: creep; debris flow/avalanche; mudflows; earthflows; solifluction
4. Slip movements: slump; debris slide
5. Fall movements: rock fall; debris fall; subsidence
6. Prevention of mass wasting

**N. Running water**

1. Runoff: sheet flow; streams
2. Types of streams and their characteristics: straight; braided; meandering
3. Concept of drainage basins
4. Factors that determine deposition vs. erosion: velocity; gradient; channel shape and roughness; discharge
5. Erosional processes: solution; hydraulic action; abrasion
6. Transportation: solution; suspension; bedload
7. Erosional features: stream valleys; undercut banks
8. Depositional features: bars; floodplains; deltas and alluvial fans
9. Steps in valley development: downcutting; lateral erosion; headward erosion
10. Rejuvenation: incised meanders; terraces
11. Stream piracy
12. Base level changes

**O. Ground water**

1. The hydrologic cycle
2. Porosity vs. Permeability
3. Types of aquifers and their characteristics: confined/artesian; unconfined; perched
4. Water tables
5. Wells
6. Relation of water tables and aquifers to springs, streams, oceans
7. Extracting water from the ground
8. Effect of pumping on aquifers
9. Pollution of ground water
10. Erosional effects of ground water: cave formation; sink holes; karst topography
11. Depositional effects of ground water: stalactites, stalagmites, etc.; terra rosa
12. Geothermal energy: geysers and hot springs; advantages and disadvantages

**P. Glaciers**
1. Theories of glacial ages
2. Formation of glaciers
3. Types of glaciers and their movement: continental; alpine; piedmont
4. Glacial budgets: positive; negative
5. Erosional features: horns; cirques; rock basin lakes; U-shaped valleys
6. Depositional features: moraines - lateral, medial, terminal, recessional; outwash; loess; varves
7. Effects of past glaciations: exposure of bedrock; sea level changes; isostatic depression and rebound; lakes - kettle, morainal, eroded, pluvial; erratics and till

Q. Deserts and wind action
1. Location of deserts: global pressure belts; leeward of mountains; distance from oceans
2. Characteristics of deserts: precipitation; soil types
3. Transportation by wind
4. Erosional features: blowouts; desert pavement
5. Depositional features: types of dunes; loess
6. Control of wind erosion and deposition: vegetation; wind
7. Wind energy: where available; technology

R. Waves, beaches, and coasts
1. Causes of waves
2. Characteristics of waves: wavelength; wave amplitude; wave refraction
3. Erosional features: undercutting and mass wasting; arches and sea stacks; long shore drift.
4. Depositional features: beaches; dunes; bars; and spits
5. Types of coasts: drowned; emergent; formed by organisms - reefs

S. Geologic Structures
1. Stress: tectonic forces; compression; tension; shear
2. Strain: elastic; plastic - folds; brittle - faults and joints
3. Folds: anticlines; synclines; horizontal vs. inclined axes
4. Faults: normal; reverse; transform
5. Representation of structural features on geologic maps: strike and dip; fault lines
6. Types of unconformities: angular unconformities; disconformities;

T. Earthquakes
1. Causes and relationship to plate boundaries
2. Types of seismic waves and their characteristics: P-waves; S-waves; Surface waves
3. Location of epicenters: seismometers; travel-time curves
4. Measurement of earthquakes: Mercalli Scale; Richter Scale; Moment Magnitude
5. Effects of earthquakes: land displacement; tsunamis
6. Distribution of earthquakes and relation to plate tectonics theory
7. Depth of earthquakes and relation to plate tectonics theory: shallow focus; deep focus
8. Pattern of earthquakes and angle of subduction
9. Earthquake prediction
10. Earthquake control

U. Earth's Interior
   1. Interpretation of seismic waves
   2. Layers of the earth and their characteristics: seismic wave classification; plate tectonics classification
   3. Principle of isostasy
   4. Geothermal gradient

V. The ocean floor
   1. Formation of oceans
   2. Methods used to study the ocean floor
   3. Continental shelf
   4. Continental slopes and turbidity currents
   5. Continental rises
   6. Abyssal plains
   7. Seamounts, guyots and aseismic ridges
   8. Mid-oceanic ridges: volcanism; earthquakes; biota
   9. Trenches: volcanism; earthquakes; ophiolites
  10. Active vs. passive continental margins
  11. Aseismic Ridges
  12. Reefs
  13. Ocean floor sediments: pelagic; terrigenous
  14. Mineral deposits and their relationship to ocean features
  15. Ages on ocean floors and relationship to plate tectonics

W. Plate Tectonics
   1. Evidence of previous continental positions
   2. The role of continental drift in development of the theory
   3. Role of paleomagnetism in promoting the theory
   4. Causes of sea floor spreading and plate motions
   5. Diverging plate boundaries
   6. Transform faults
   7. Converging plate boundaries
   8. Types of convergences: ocean-ocean; ocean-continent; continent-continent
   9. Back arc spreading
  10. Names, locations, and relative motions of the plates

X. Mountain belts
   1. Characteristics of mountain belts formed at converging boundaries: faults; folds; metamorphism; batholiths
   2. The evolution of mountain belts: accumulation stage; orogenic stage; uplift and block faulting stage
   3. The growth of continents by exotic terranes

Y. Geologic resources
   1. Definition of a resource
   2. Renewable vs. nonrenewable resources
   3. Exploration for resources and locations as related to plate tectonics
4. Mineral resources: metallic ores; non-metallic ores  
5. Rock resources: igneous; sedimentary;  
6. Energy sources: fossil fuels; uranium; other sources of energy  
7. Methods of obtaining these resources  
8. Effects on the environment from mining  
9. Conservation of resources by substitution, recycling, and more efficient use  

IV. METHODS OF STUDENT EVALUATION MAY INCLUDE ANY OF THE FOLLOWING:  
A. Quizzes  
B. Lecture exams  
C. Participation in class discussions  
D. Reports on current literature in geology  
E. Worksheets on textbook comprehension  

V. RESOURCES MAY INCLUDE ANY OF THE FOLLOWING:  

Description of Assessment and/or Evaluation of Student Learning  
See Course Outline  

Master Syllabi and Working Syllabi (if both are used)  
See Course Outline  

Additional Documentation  

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