Butler Community College
Behavioral Science, Math, Science, and
Physical Education Division

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Revised Fall 2011
Implemented Spring 2012

COURSE OUTLINE
Physical Geology

Course Description
PS 102. Physical Geology. 4 hours credit. This course will enable the student to explain introductory material to geology in all aspects including some historical concepts. The student will explain the fundamentals of physical geology with an emphasis on the plate tectonics explanation of such phenomena as volcanism, earthquakes, and mountain building. The student will explain the importance of streams, weathering and erosion, glaciations, and wave action in shaping the land. The student will discuss minerals, rocks and natural resources. Students will participate in laboratory work including identification of minerals and rocks, use of topographic and geologic maps, and use and interpretation of aerial photographs in geology. This course will meet for three hours of lecture and two hours of laboratory each week.

Course Relevance
The impact of physical geology in everyday life is phenomenal. The ability to see science in action on the micro (molecular) and macro scale is necessary to develop a fuller knowledge and understanding of the world around us. Physical Geology will enrich his/her appreciation of the world and help him/her better understand the studies of science and the scientific methods.

Required Materials
Lutgens. *Essentials of geology.* Old Tappan, NJ: Prentice Hall.

Tusa, D. and Busch Richard. *Laboratory manual in physical geology*. Old Tappan, NJ: Prentice Hall.

* - For complete textbook information, refer to http://www.butlercc.bkstr.com

TeleCourse materials
Carlson. *Earth revealed: Physical geology*. McGraw-Hill
Earth Revealed, (CD) Twenty-six, 30-minute lessons

Online materials
Earth Revealed Lab Kit (Rocks and Minerals). Monrovia, CA: Burminco.

The specific experiments selected are left to the discretion of the individual instructor and are not limited to those experiments found in the laboratory manual list above.

Supplemental materials
Lebow. *Study guide for introductory geology: Earth revealed*. Dubuque, IA: Kendall/Hunt Publisher.

Butler Assessed Outcomes
The intention is for the student to be able to:
1. Analyze scientific materials in various forms.
2. Understand the scientific method.
3. Communicate, read, and understand scientific materials.
4. Apply scientific reasoning to real world problems.

Learning PACT Skills that will be developed and documented in this course
Through involvement in this course, the student will develop ability in the following PACT skill area(s):

Personal Development Skills
1. Personal management
   - Through the production of either an essay or questionnaire the student will reflex on their personal management skills.

Analytical Thinking Skills
1. Critical thinking
   - Through the production of various mathematical, graphical, experimental and written assignments, the student will demonstrated scientific reasoning.

Communication Skills
1. Creation and delivery of messages
   - Through a variety of methods using either the internet and/or computer the student will produce a product to express their findings laboratory reports.

Technology Skills
1. General computer use
   - Through the production of electronic-facilitated research, preparing the graphs, and manipulation of data, the student develops basic computer skills

Major Summative Assessment Task(s)
The learning outcome(s) and learning PACT skill(s) will be demonstrated by:
1. Writing laboratory reports, which include observations, and analysis of the experiment
2. Final assessment in the course using the department's comprehensive final exam
3. Demonstrate computer skills using word processor, graphing, and computer animations.

Course Content
I. Skills or Competencies – Actions that are essential to achieve the course outcomes:
   A. Mathematics
   B. Writing
   C. Reading
   D. Computer Literacy
   E. Teamwork
II. Themes – Key recurring concepts that run throughout the course:
   A. Scientific method
   B. Scientific reasoning
III. Issues - Key issues that will be addressed in this course: areas of conflict that must

be understood in order to achieve the intended outcome:
A. The balance between the conceptual and mathematical models
B. The cumulative nature of science and the world
C. The cumulative influence of scientific discoveries and the subsequent application of the discoveries
D. The balance between “wet” lab science and computer interfacing, collection and analysis of data

IV. Concepts – Key concepts that must be understood to address the issues
A. Mathematics
B. Scientific method
C. Scientific reasoning
D. Scientific writing
E. Scientific principles
F. Word processing
G. Excel spreadsheet
H. Graphing

Learning Units

I. Apply scientific processes (i.e. observation, categorization, forming hypotheses, prediction) to the phenomena of the Earth
A. Describe in scientific terms the development of the field of geology from catastrophism to modern day plate tectonics
B. Describe the Earth as a planet and the various systems composing it

II. Describe the nature and properties of minerals
A. Discuss the composition and structure of minerals
B. Discuss the various properties of minerals
C. Use these properties to identify hand specimens

III. Describe the nature, properties and origin of igneous rocks
A. Discuss the crystallization of magma
B. Describe, using the Bowen reaction series, how different composition igneous rocks form
C. Discuss intrusive and extrusive (volcanoes) structures and how they form
D. Describe the relationship between igneous activity and plate tectonics

IV. Describe the nature, properties, and formation of sedimentary rocks
A. Discuss the types of weathering and the conditions under which they operate
B. Discuss the formation of various types of soil and environmental in which they form
C. Distinguish between the various types of sedimentary rocks
D. Use the properties of sedimentary to classify and identify hand samples

V. Describe the nature, properties, and formation of metamorphic rocks.
A. Discuss the effects if the agents of metamorphism
B. Discuss metamorphic environments of formation and use this information to

determine past environments and climates
C. Use the properties of metamorphoric rocks to classify and identify hand samples

VI. Describe the phenomena known as mass-wasting
A. Distinguish between and classify the different types of mass-wasting
B. Discuss the controls and triggers of these types
C. Identify the geologic hazards associated with various processes

VII. Discuss the nature and phenomena of running water and stream flows
A. Describe the hydrologic cycle in detail
B. Discuss stream flow and the changes in stream flow that occur from upstream to downstream
C. Explain how streams transport and deposit sediments
D. List and describe the features of both narrow and wide stream valleys
E. Describe the various types of drainage networks and drainage patterns
F. Discuss the causes of floods and the methods used for flood control

VIII. Discuss the importance of groundwater as a resource and as a geological agent.
A. Define the water table
B. Explain the difference between porosity and permeability and how each relates to the movement of groundwater
C. Describe springs, geysers, wells, and artesian wells
D. List some environmental problems associated with groundwater
E. Discuss the factors that contribute to groundwater contamination
F. Describe the geologic work of groundwater and list several features that are produced by groundwater activity

IX. Discuss the nature and properties of glaciers
A. Describe the two types of glaciers
B. Discuss the formation and movement of glaciers
C. Describe several landforms created by glacial erosion
D. Discuss the types of glacial deposits
E. Describe several landforms created by glacial deposits.
F. Identify some of the indirect effects of Ice-Age glaciers
G. Discuss the theories for the causes of glacial ages

X. Discuss the extent of the world ocean
A. Describe the differences between passive and active continental margins and the features associated with each
B. Diagram a typical passive continental margin, showing the continental shelf, shelf break, the continental slope, and the continental rise in their proper locations
C. Discuss submarine canyons, turbidity currents, and turbidities
D. List, describe, and illustrate the features of a typical deep-ocean basin

XI. Discuss earthquakes and the Earth’s interior

A. Describe what an earthquake is and what causes it
B. Discuss the types of seismic waves emitted during an earthquake and the instrument used to record them
C. Explain how the epicenter of an earthquake is located
D. Locate the principal earthquake zones on Earth
E. Describe how earthquake strength is expressed
F. List and describe the major zones of Earth's interior
G. Describe the differences between continental and oceanic crust

XII. Discuss the theories of plate tectonics
A. Describe continental drift, and list the evidence used to support the theory
B. List the main objections to the continental drift hypothesis
C. Discuss the theory of plate tectonics and how it departs from the continental drift hypothesis
D. List and describe the various types of plate boundaries
E. Discuss the evidence used to support the plate tectonics theory
F. Describe the possible driving mechanisms for plate motion

XIII. Discuss the mechanisms and types of mountains being built
A. List and describe the two basic types of rock deformation
B. Discuss the most common types of folds and faults
C. Compare Aleutian- and Andean-type mountain building
D. Explain how continental accretion relates to mountain building
E. Discuss the concept of isostasy and its relation to mountain building

XIV. Discuss the principles and theories used to develop Geologic time
A. Explain the difference between numerical and relative dates
B. List the principles that are used to determine the relative ages of rock units
C. Discuss the different types of unconformities
D. Define a fossil and list the conditions that favor the preservation of organisms as fossils
E. Describe how fossils are used to correlate rock units of similar ages in different places
F. Explain radioactivity and how radiometric dating is used to determine reliable numerical dates for geological events
G. Discuss the geologic time scale
H. Explain why it is difficult to assign reliable absolute dates to samples of sedimentary rock

XV. Make observations and measurements, handle data, calculate results, and draw conclusions from observations and/or experimental data
A. Communicate results through written laboratory reports
B. Demonstrate safe work habits in the lab
C. Construct a graph and interpret graphical data
D. Use critical thinking to solve a variety of problems

Learning Activities
Independent and collaborative learning activities will be assigned within and outside the classroom and laboratory to assist the student to achieve the intended learning outcomes. Classroom discussion, lecture, drills/skill practice, textbook reading/written assignments, and other activities at the discretion of the instructor, will also contribute to the learning process.

Grade Determination
The student will be graded on learning activities and assessment tasks. Grade determinants may include the following: tests, projects, quizzes, homework, laboratory experiments, written laboratory reports, and other methods of evaluation at the discretion of the instructor. A departmental comprehensive final will be administered at the end of the semester.