Butler County Community College **Bill Forrest**
Behavioral Science, Math, Science, Fall 2001
and Physical Education Division

Course Outline
Physical Geology

Course Description:

PS102. Physical Geology. 4 credit hours. An introduction to geology in all aspects including some historical concepts. The fundamentals of physical geology will be studied with an emphasis on the plate tectonics explanation of such phenomena as volcanism, earthquakes and mountain building. The importance of streams, weathering and erosion, glaciation, and wave action in shaping the land will be discussed. The study of minerals, rocks, and some discussion of natural resources will be undertaken. Laboratory work will include 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.

Textbook:

Lutgens, (2000). Essentials of Geology, (7th Edition). Prentice Hall.

Lab Manual:

Dennis Tusa and Richard M. Busch, (2000). Laboratory Manual in Physical Geology, (5th Edition). Prentice Hall.

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 listed above.

Course Objectives:

At the completion of this course, the student should be able to:

1. 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.

2. Describe the mature and properties of minerals

    a. discuss the composition and structure of minerals
    b. discuss the various properties of minerals (i.e. color, luster, streak, etc.)
    c. use these properties to identify hand specimens.

3. Describe the mature, 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.

4. 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 (i.e. detrital, chemical, bioclastic)
    d. use the properties of sedimentary to classify and identify hand samples.

5. Describe the nature, properties, and formation of metamorphic rocks

    a. discuss the effects of the agents of metamorphism (heat, pressure, active fluids)
    b. discuss metamorphic environments of formation and use this information to determine past environments and climates
    c. use the properties of metamorphic rocks to classify and identify hand samples.

6. 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.

Topical Outline:

I. Introduction

A. Scientific Method and Geology
B. History of geology

1. Catastrophism
2. The work of James Hutton
3. Continental Drift
4. Plate tectonics

C. Overview of the Earth

1. Hydrosphere
2. Atmosphere
3. Solid Earth
4. Biosphere

II. Minerals

A. Characteristics of minerals
B. Composition and structure of minerals

1. Atomic structure
2. Chemical bonding
3. Isotopes and radioactive decay
4. Naming compounds and writing chemical formulas

C. Properties of minerals

1. Color
2. Streak
3. Luster
4. Hardness
5. Cleavage
6. Crystal form
7. Other properties

Lab: Mineral Properties and Identification

III. Igneous Rocks

A. Crystallization of magna

1. Igneous textures
2. Chemical composition

B. Bowen Reaction Series

1. Magmatic differentiation
2. Assimilation and magma mixing

C. Volcanoes and other igneous activity

1. Types of volcanoes (shield cone, cinder cone, stratovolcanoes)
2. Lava types associated with different volcano types
3. Intrusive structures (batholiths, stocks, dikes, sills, etc)

D. Igneous activity and plate tectonics

1. Origins of magma
2. Partial melting
3. Distribution of igneous activity

Lab: Properties and Identification of Igneous Rocks

IV. Sedimentary Rocks

A. Weathering

1. Mechanical
2. Chemical

B. Soil

1. Types
2. Soil control factors
3. Soil profiles

C. Sedimentary rock types

1. Detrital sedimentary rocks
2. Chemical sedimentary rocks
3. Bioclastic sedimentary rocks

D. Classification procedures for sedimentary rocks

1. Sedimentary environments of formation
2. Sedimentary structures
3. Procedures for identification

Lab: Properties and Identification of Sedimentary Rocks

V. Metamorphic Rocks

A. The agents of metamorphism

1. Heat
2. Pressure
3. Active fluids

B. Changes caused by these agents
C. Metamorphic environments
D. Determination of past environments and climates from the rock record in

metamorphic rocks

E. Common metamorphic rock properties

1. Foliated
2. Nonfoliated

Lab: Properties and Identification of Metamorphic Rocks

VI. Mass Wasting

A. Mass wasting processes

1. Slump
2. Slide
3. Flow

B. Classification
C. Mass wasting controls and triggers
D. Hazards associated with mass wasting

Lab: Use of Topographical Maps and Aerial Photos

VII. Running Water and Stream Flow

A. Streamflow Characteristics
B. Work of streams and long term changes
C. Causes and control of floods

Lab: Stream Processes, Landscapes, Mass Wastage, and Flood Hazards

VIII. Groundwater

A. Importance
B. Movement of underground water and factors affecting that movement
C. Environmental problems and solutions associated with groundwater

Lab: Groundwater Processes, Resources, and Risks

IX. Glaciers and Glaciation

A. Formation and Movement of Glaciers
B. Glacial erosion
C. Glacial landforms
D. Glacial deposits
E. Ice ages

1. Glacial formation
2. Some indirect effects
3. Relation of ice ages to plate tectonic activities

Lab: Glacial Processes, Landfonns, and Indicators of Climate Change

X. The Ocean Floor

A. Ocean floor features

1. Active continental margins
2. Passive continental margins

B. Deep ocean floor features

1. Ocean basins
2. Mid-ocean ridges

XI. Earthquakes and Earth's Interior

A. Earthquake - definition
B. Causes
C. Seismic wave types

1. P-waves
2. S-waves
3. Surface waves

D. Epicenter and focus
E. Earthquake intensity and magnitude
F. Destruction from earthquakes

1. Types of damage
2. Prediction of earthquakes

G. The Earth's interior

1. Use of seismic waves to study internal structure
2. Behavior of different types of waves

H. Earthquake hazards

Lab: Earthquake Hazards and Human Risks

XII. Plate Tectonics

A. Continental drift and plate tectonics

1. Similarities
2. Differences

B. Evidence for continental drift and why it failed
C. New evidence from the fifties and sixties
D. Plate movement
1. Pre-Pangaea
2. Post-Pangaea

E. Proposed driving mechanisms
1. Convection currents model
2. Slab pull model
3. Others

Lab: Plate Tectonics

XIII. Mountain Building

A. Mechanisms for crustal uplift
B. Types of deformation

1. Folds
2. Faults
3. Joints

C. Mountain types

1. Fault block
2. Upwarped
3. Folded

D. Relation of mountain building to plate tectonic activity

XIV. Geologic Time

A. Principles used to develop the relative time scale

1. Superposition
2. Original horizontality
3. Cross-cutting relations
4. Faunal succession

B. Fossils

1. Types
2. Fossils and correlations

C. Radioactive dating for absolute age

1. Radioactivity
2. Half-life
3. Radiometric dating

D. The Geologic Time Scale

XV. Other Topics (optional) - (time permitting)

A. Earth history
B. Deserts
C. Shorelines
D. Mineral resources

Methods of Instruction:
The following teaching/learning activities will assist the student to achieve the course objectives: lecture, individual help sessions, computer activities (including tutorial, drill and practice, and simulation), videotapes and films as available and textbook assignments.

Methods of Evaluation:
Methods of evaluation may include the following: tests (including both objective questions and brief essay questions), daily assignments; class participation; and other projects or assignments at the discretion of the individual instructor.

Telecourse:
Text:
McGeary, David and Charles Plummer. (2001). Physical Geology: Earth Revealed (with CD Rom), (4th Edition). McGraw Hill.

Study Guide (Optional):
Lebow. (1998). Study Guide for Introductory Geology: Earth Revealed. (3rd Edition). Kendall/Hunt Publisher.

Videos:
Earth Revealed, (26) 30-minute lessons.

Lab Manual:
Busch, Richard M. (2000). Laboratory Manual in Physical Geology, (5th Edition). Prentice Hall Publishers.

Methods of Instruction for Telecourse:

Independent study of audio/video materials augmented by text and study guide; collaboration and participation with class members and faculty via available means. Faculty role is facilitator of learning experiences.

Method of Instruction for Online Course:
The following online teaching/learning activities will assist students to achieve course objectives: posted web pages, threaded discussions, written assignments, assigned reading, and interaction with instructor through e-mail and discussion boards.

Laboratory Kit for Online Course (Required):
Earth Revealed Lab Kit (Rocks & Minerals). Burminco.