Modesto Junior College
Course Outline of Record

GEOL 161

I. OVERVIEW
The following information will appear in the 2012 - 2013 catalog

GEOL 161 Physical Geology 4 Units

Study of the physical and chemical processes that shape the earth, including plate tectonics, volcanism, weathering, and erosion; the composition of the earth; and geologic hazards such as mass wasting, flooding and earthquakes. Laboratory topics include rock and mineral identification, and the use of maps and aerial photographs to understand erosional and tectonic processes.

Field trips might be required. (A-F or P/NP - Student choice) Lecture /Lab
Transfer: (CSU, UC) General Education: (MJC-GE: A ) (CSU-GE: B1, B3 ) (IGETC: 5A )

II. LEARNING CONTEXT
Given the following learning context, the student who satisfactorily completes this course should be able to achieve the goals specified in Section III, Desired Learning:

A. COURSE CONTENT

1. Required Content:

   a. Introduction to basic principles of geology and the scientific method.

      i. Scientific Method

      ii. Uniformitarianism and recognition of geologic time

      iii. Nebular hypothesis of the origin of the Solar System and the earth

   b. Earth Materials

      i. Atomic theory and chemical bonding

      ii. Minerals and mineral resources

      iii. Igneous rocks

      iv. Weathering and soils

      v. Sedimentary rocks

      vi. Metamorphic rocks

   c. Tectonic Processes

      i. Earthquakes

      ii. Interior of the earth

      iii. Features of the ocean floor

      iv. Plate tectonics
a. Divergent Plate Boundaries
b. Convergent Plate Boundaries
c. Transform
d. Hot Spots and Terranes

v. Evolution of the continents and mountain-building

d. Erosional Processes
i. Mass wasting
ii. Rivers and streams
iii. Groundwater
iv. Glaciers and glaciation
v. Deserts and eolian processes
vi. Shorelines

e. Mineral and Energy Resources
i. Renewable resources
ii. Nonrenewable resources
iii. Fossil fuels and energy alternatives
iv. Urban geology and environmental planning

2. **Required Lab Content:**

a. Physical properties and identification of minerals
   i. Luster, hardness and cleavage of minerals
   ii. Rock forming minerals
   iii. Ore minerals

b. Identification of common rocks
   i. Plutonic igneous rocks
   ii. Volcanic igneous rocks
   iii. Clastic sedimentary rocks
   iv. Chemical sedimentary rocks
   v. Biogenic sedimentary rocks
   vi. Foliated metamorphic rocks
vii. Granular metamorphic rocks

c. Use of topographic maps and stereophotographs
   i. Contours and map symbols
   ii. Vertical air photography
   iii. Stereoscopic vision

d. Rock deformation, faults and folds
   i. Anticline, syncline, dome and basin
   ii. Dip-slip faults and strike-slip faults

e. Use of geologic maps
   i. Strike and dip symbol, fold symbols
   ii. Geologic cross-sections
   iii. Geologic time scale

f. Erosional Processes
   i. River
   ii. Wind and Desert Processes
   iii. Glaciers
   iv. Shorelines

B. HOURS AND UNITS

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C. METHODS OF INSTRUCTION (TYPICAL)

Instructors of the course might conduct the course using the following method:

1. Related material will be presented through designated lecture and specific laboratory exercises.
2. Audiovisual materials will be used to illustrate particular topics.
3. Stereoscopes, topographic and geologic maps, rock and mineral samples, hardness kits, microscopes, and computer simulations will be used to demonstrate course principles.

D. ASSIGNMENTS (TYPICAL)
1. **EVIDENCE OF APPROPRIATE WORKLOAD FOR COURSE UNITS**

   *Time spent on coursework in addition to hours of instruction (lecture hours)*

   a. Weekly textbook readings
   b. Weekly written homework assignments
   c. Weekly prelaboratory assignments
   d. Study for examinations

2. **EVIDENCE OF CRITICAL THINKING**

   *Assignments require the appropriate level of critical thinking*

   a. Laboratory exercises require a student to identify mineral and rock samples using their physical properties such as luster, hardness, cleavage, grain size or texture.
   b. Laboratory exercises using satellite imagery, stereo-photographs, and topographic maps require a student to evaluate the primary geological processes acting on a region, such as tectonic uplift, faulting, volcanism, or erosion.
   c. Given a series of geologic cross-sections or three dimensional models, students will assemble a sequence of events that explains the geologic history that formed each outcrop.
   d. Photographs of significant geologic localities are projected, and students will use visual clues to identify the important geologic processes active in the photograph.

   **Example Questions:**

   a. "Given the following mineral samples, determine the relevant physical properties, and use the properties to identify the mineral."
   b. "Use topographic maps of Mt. Shasta and Crater Lake to make a topographic profile of the volcanic features. Compare the profiles to estimate the height of the volcano that once existed at Crater Lake."

E. **TEXTS AND OTHER READINGS (TYPICAL)**


III. **DESIRED LEARNING**

A. **COURSE GOAL**

   As a result of satisfactory completion of this course, the student should be prepared to:

   identify the basic rock-forming minerals, and the most common igneous, sedimentary and metamorphic rocks. They will analyze topographic and geologic maps for evidence of tectonic and erosional processes. They will compare and contrast the geologic activity that occurs at divergent, convergent and transform plate boundaries, and explain the differences in faulting, volcanism and erosion at each.

B. **STUDENT LEARNING GOALS**

   Mastery of the following learning goals will enable the student to achieve the overall course goal.

   1. **Required Learning Goals**

      Upon satisfactory completion of this course, the student will be able to:
a. analyze the elements of the scientific method and explain how these principles apply to the study of the earth.

b. explain the geologic processes of tectonism, erosion, and mineral and rock formation.

c. use the basic geologic principle of uniformitarianism and the examples of present-day geologic processes to explain the formation and evolution of the features of the earth.

d. assess and evaluate competing hypotheses regarding the concept of geologic time, the origin of the earth and solar system, and plate tectonics.

e. explain the necessary role of the geologist in the modern technological society in areas such as urban planning, the search for new energy resources, and environmental research.

f. compare the physical and chemical properties of minerals, and identify the most common minerals and igneous, sedimentary and metamorphic rocks.

2. **Lab Learning Goals**
   
   Upon satisfactory completion of the lab portion of this course, the student will be able to:

   a. test for the physical and chemical properties of minerals, and identify the most common minerals and igneous, sedimentary and metamorphic rocks.

   b. interpret tectonic features and landforms (faults, folds and unconformities) from aerial photographs and topographic maps.

   c. interpret erosional features and landforms (rivers, mass wasting, wind, glaciers and wave action) from aerial photographs and topographic maps.

   d. distinguish three-dimensional rock structures and faults from geologic maps.

   e. differentiate structures and age relationships from geologic cross-sections.

IV. **METHODS OF ASSESSMENT (TYPICAL)**

A. **FORMATIVE ASSESSMENT**

1. Weekly homework assignments

2. Written laboratory analyses (graphs, cross-sections, maps and questions)

3. Weekly quizzes

B. **SUMMATIVE ASSESSMENT**

1. Written mid-term examinations to include essays

2. Final examination