

**Geology 102 – Introduction to Geology (4)**  
**Course Outline** **GE B3**

**Prerequisites for GEOL 102** – None. 4 lectures. Fulfills GE B3.

Processes responsible for the Earth's minerals, rocks, and structure surface features. Volcanism; mountain building; plate tectonics; weathering. Erosion and deposition by streams, glaciers, wind and waves. Geological resources, earth hazards, and interaction of man with global processes.

**Learning Objectives and Criteria:**

Upon completion of the course the student is expected to:

- a. Know essential facts about the nature of the solid Earth and its processes. These include basic knowledge, and some insight into the scientific approaches taken by the scientific community to acquire those facts.
- b. Know why a rock formed and will be introduced to past and present ideas and to the scientific method as it has been applied to the problem (e.g., the many hypotheses on the nature of the Earth's core converge on a single solution, which is accepted by science even though no one has ever "seen" the core). Mistakes of the past will be discussed, as will the idea that the theories of today may be changed in the future.
- c. Know how geology intersects with their personal lives, with the metals and energy they use, and with the complex social implications of 'good' and 'bad' geologic interpretation in civil engineering. There will be discussions of the intersection of the physical and life sciences, of physics and chemistry with geology, and the overlap of many disciplines that will reinforce the value of a well-rounded education.
- d. Students will be introduced to the geologic features of different areas of the US, the regional problems associated with geology, such as the imminent collapse of the Ogallala groundwater resource, and to the hazards associated with geologic phenomena such as volcanic eruptions, earthquakes, floods and altered sea level. It is hoped that the understanding of how landforms, such as Half Dome in Yosemite Park, are formed will enrich their lives as they travel by adding a new perspective on how they "see" the land.

**Text and References:**

“**Essentials of Geology**” 3<sup>rd</sup> Edition, by Steven Marshak, WW Norton Publishers.

**Content and Method:**

**Content: GEOL 102 will adhere to the following topics:**

Week 1:

General Introduction, planet origins, minerals, economic minerals. This material introduces scientific hypotheses on the origins of the solar system, relationship of geology to astronomy, the concept of gravitation, the nature of molecules and basic chemistry in the formation of minerals. The resource and economic problems related to the extraction of finite amounts of minerals will be treated in much greater depth to emphasize the importance of geology in our daily lives. This introduces students to the manner in which geology interplays with the world scene.

Week 2:

Rocks and rock cycle, igneous processes and plutonic rocks. This section introduces students to scientific classification systems, the evolution of modern thinking on the origin of magma, and different interpretations that are forced on the observer as a result of fundamental paradigm shifts such as the 'discovery' of plate tectonics.

Week 3:

Volcanic processes and rocks, weathering and soils. The student is introduced to the world of natural disasters, and to risk evaluation. The relationships between the chemistry and the physical attributes of a lava are examined. The origins and importance of soils, their development in different climatic conditions, the social problems of soil erosion and deforestation are explored, including a discussion of the role of modern farming in soil composition.

Week 4:

Sedimentary processes and rocks, energy resources, metamorphic rocks. Description of major groups of rocks and the processes that formed them. Uniformitarianism is compared to catastrophism, and the theory that the present is the key to the past is explained. Oil, gas and coal are discussed in greater depth in terms of their formation, their finite quantity, and the social and political issues associated with their depletion. The evolution of thought on the origins of metamorphic rocks, including the inability to explain certain rocks on the basis of older ideas of metamorphism, and the salvation by plate tectonics theory.

Week 5:

Geologic time and its measurement, folding and faulting, large scale deformation. Issues introduced in the discussion of sedimentary rocks are continued, including analysis and rejection of the arguments by Creationists for a very young Earth.

Week 6:

Mass wasting, water and hydrologic cycle, groundwater. landslides, mudflows, floods, and other issues associated with mass wasting of slopes and the flow of water are explained. Landscape evolution, and the nature of change relative to the human lifetime. River and slope engineering, and a brief introduction to geotechnical engineering, hydrological engineering, problems in groundwater supply.

Week 7:

Rivers and landforms, winds and deserts. Material covered in Week 6 is expanded upon. Movement of material by wind is discussed, together with the landforms and processes, and the problems of life in the desert.

Week 8:

Glaciation, landscape evolution. The nature of glaciated places, Ice Ages and causes, long-term evolution of the landscape, general discussion of the ideas underlying geomorphology and physical geography. Students will be able to "read" the landforms around them for their origins and ages.

Week 9:

Oceans and marine geology, earthquakes. The underwater 70% of the globe is described, including the reasons why mapping did not commence until after WWII. The role of the sea floor mapping in decoding the continental drift riddle. Earthquakes and their distribution, their physics, relationship to plate tectonics, nature of seismic waves, nature of damage, and use in the exploration of the planet's interior.

Week 10:

Earth's interior, plate tectonics. The relationship of the interior of the Earth to plate tectonics, and the slow evolution of the theory. Early work of Wegener, and the tragedy of scientific prejudice. The role of interdisciplinary knowledge between the Life Sciences and the Physical Sciences in the search for answers. The effect of major paradigm shifts in geologic thought regarding continental drift and the scientific method.

**Method:**

GEOL 102 is a 4-unit lecture course. It is expected that all instructors will use the same text, and will coordinate at intervals to ensure that each is at about the same point in the schedule.

**Methods of Assessment:**

Student grades are based on weekly problem sets, midterms, and a final exam. Exams will consist of multiple choice and true/false questions in addition to short-answer problems. Extra-credit opportunities are offered in the form of self-guided field trips to local geologic sites.