The Earth GEO 102
Department of Geosciences
Stony Brook University
Instructor of Record: Hanna Nekvasil

PROGRAMMATIC GOAL:
The primary goal of this course is to provide an overview of the geologic processes that have shaped the Earth, the interrelatedness of these processes, and the nature of the products of these processes. By the end of this course students will be prepared to understand how geologic processes have changed and will continue to change the Earth’s surface over time, how processes occurring at depth relate to surface evolution, and which changes in the physical environment can be attributed to anthropomorphic activities.

COURSE CONTEXT:
The focus of this course is introductory context building as it links, through a broad overview, the geological processes will be covered in detail in the required and elective courses for the Geology and Earth and Space Science majors. It has also been designed as a service course to the university community. The overview provided by this course develops scientific literacy and contributes to meeting the need for all to be able to make informed decisions about policies that impact the environment for current and future generations. Because of the diverse contexts for this course, student backgrounds and aptitudes are highly varied. Therefore, the teaching goals are (i) to provide an overview of the Earth as a system comprehensible to the science and non-science student, (ii) to facilitate growth in the ability of students to integrate concepts and predict outcomes of geological processes, and (iii) to foster the ability for the students to communicate concepts to each other. Testing is used to provide an incentive to reinforce concepts in a timely manner, while minimizing the grading penalty common to students with lesser science background and interest.

INSTRUCTIONAL COMPONENTS:

A. Concept presentation
   This course is lecture style, using Powerpoint presentations. These presentations are posted on Blackboard ahead of time for students to download to facilitate note-taking and for later study.

B. Concept reinforcement
   i. Bonus clicker quizzes on the material presented after each lecture in open format encouraging students to discuss, debate, and practice expressing their understanding orally to each other.
   ii. Monthly formal clicker quiz on subset of topics covered. More complicated two tiered reasoning required. Open discussion format.
iii. Hour long in-class examinations. In depth reading and review of lecture notes is fostered by providing exam questions and multiple choice answer selections for study prior to the examination. This provides an incentive to study and allows students to interact with one another in the study process. Examinations are individual and closed to notes and discussion to ensure that each student has the incentive to individually learn the material.

C. Concept development

The sequence of topics covered in this course greatly differs from what is traditional for this course. Geologic process is emphasized over product, which allows for topics (e.g., mineralogy) that traditionally have been difficult for students to comprehend and retain to be presented piecemeal in the context of a process with multiple opportunities for reinforcement.

I. The early hot Earth
i. The formation of the universe, our solar system, and the Earth and Moon
ii. Core formation and the Earth’s magnetic field
iii. Cooling of the molten exterior
   Crystallization of minerals
   • Chemical bonding, stoichiometry, unit cells, igneous silicates
   • Diversification of basaltic magma due to crystallization of minerals
   • Degassing of magma and the formation of an atmosphere
   Basaltic volcanic landforms
   • Formation and characteristics
   • Breakdown through mass wasting, mechanical and chemical weathering
   Transport, sorting, accumulation and modification of sediment by rivers
   Lithification of clastic sedimentary rocks

II. The cooling solid Earth
i. Mantle upwelling and fracturing the crust
ii. Brittle behavior of crust, formation of normal faults
iii. Earthquakes
   Movement, generation of body and surface waves
   Travel times and location of epicenter
   Exploring the Earth’s interior
iv. Cold basalt, the asthenosphere, and reverse faults – the beginning of subduction
v. Linking extension and subduction..ridge push and/or slab pull
vi. Decompression partial melting of the mantle and generation of new basalt
vii. Basalt as a recorder of changes in the magnetic field

III. Making continental crust
i. Alteration of hot basalt at the seafloor
ii. Subduction and the formation of amphibolite
iii. Dehydration and hydrous melting and the formation of andesite
iv. Buoyancy of island arc andesite
v. Continental drift
   Accretion and the formation of mountain belts
vi. Metamorphic regimes in mountain belts and the production of metamorphic rocks
   Changes in minerals as a function of pressure, temperature, and protolith
   Changes in rock texture

IV. Modifying the continental crust
i. Glaciers
   Glacial ice
   • Mountain glaciers vs. ice sheets
   • Internal flow of glaciers
   • Glacial advance and retreat
   Erosional features
   Depositional features
   Rivers basins and Groundwater systems
   Pluvial lakes
ii. Coasts
   Erosional features
   Sedimentary features
   Limestone
iii. Deserts

COURSE LOGISTICS:
The course content is distributed through 2 80-minute professor-given lectures per week. A graduate teaching assistant is available for help with clarification of course content.

EXPECTED COURSE OUTCOMES:
By the end of the course, students should be able to:

1) Read about a recent earthquake and
   i. identify the tectonic regime in which it was produced
   ii. indicate how the epicenter was found
   iii. explain the meaning of its magnitude
   iv. predict the nature of other associated hazards, such as tsunami and volcanic eruptions

2) Read about a recent volcanic eruption
   i. identify the tectonic regime in which it was produced
   ii. predict how explosive it could be
   iii. indicate the nature of pyroclastic deposits it would produce
iv. predict the type of lava compositions that would eventually be produced

3) Read about global warming and
   i. discuss natural variation in ice ages over time
   ii. list factors that contribute to climate change

4) Look at a sedimentary rock, igneous, and metamorphic rock
   i. discuss the processes that lead to the formation of the mineral grains in it
   ii. indicate in which tectonic environment it may have formed
   ii. recognize the interrelatedness of igneous sedimentary and metamorphic processes.

GOALS FOR BROADER SKILLS:
   A) To be able to pull together varied information to answer multi-tiered questions and orally defend his/her answers
   B) Look for interrelatedness of concepts
   C) Increase scientific literacy

ASSESSMENT OF ATTAINMENT OF COURSE GOALS:
Student attainment of course goals is assessed through in class quizzes and exams.

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Class Conduct
All cell phones, iPods, and other electronic devices should be turned off during class to minimize distractions and interruptions. Class participation, including questions and discussion is encouraged. Please treat all others in a respectful manner appropriate for a university setting.