Comprehensive Course Syllabus

Geology

Course Description:

This course provides an introduction to geology in the context of the Earth System, with a focus on geological problem-solving. Students will examine interactions between the lithosphere, atmosphere, hydrosphere, and biosphere; study Earth materials and their distribution on our planet; evaluate evidence for key events in Earth history; and explore the relationship between geology and human societies. Students will gain experience with key methods of geological investigation via hands-on work with geological specimens and data, supplemented by discussions and readings from primary literature. For the final project, students will develop expertise with particular subfields of geology and work in teams to apply their understanding of geology to current problems.

INSTRUCTOR:

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Meeting Days, Time and Room(s)
BD 3-4

Text(s) / Materials:
Text: Marshak, Essentials of Geology
Secondary text: Johnson et al., An Introduction to Geology, https://opengeology.org/textbook/
Students will also receive additional materials such as teacher generated lab assignments, supplementary background reading, samples, data sets, scientific papers for discussion, graph paper, etc.
Required materials: Notebook, laptop, pencils

Essential Content:
This course will cover Earth systems, Earth materials, Earth structure, and case studies from Earth history. Through labs, discussions, and projects, students will gain experience with key geological methods such as observing, describing, and interpreting Earth materials; connecting past and present; using geographically and temporally specific examples to deduce underlying processes; and integrating multiple lines of evidence to compensate for incomplete data. In the process, students will also develop their temporal reasoning and spatial thinking skills. This course will address the following Next Generation Science Standards:

NGSS-HS-ESS1 Earth's Place in the Universe

B. Kepler's laws describe common features of the motions of orbiting objects. Observations from astronomy and space probes provide evidence for explanations of solar system formation. Changes in Earth's tilt and orbit cause climate changes such as Ice Ages.

C. The rock record resulting from tectonic and other geoscience processes as well as objects from the solar system can provide evidence of Earth's early history and the relative ages of major geologic formations.

NGSS-HS-ESS2 Earth's Systems

A. Feedback effects exist within and among Earth's systems.

B. Radioactive decay within Earth's interior contributes to thermal convection in the mantle.

C. The planet's dynamics are greatly influenced by water's unique chemical and physical properties.

D. The role of radiation from the sun and its interactions with the atmosphere, ocean, and land are the foundation for the global climate system. Global climate models are used to predict future changes, including changes influenced by human behavior and natural factors.

E. The biosphere and Earth's other systems have many interconnections that cause a continual coevolution of Earth's surface and life on it

NGSS-HS-ESS3 Earth and Human Activity

A. Resource availability has guided the development of human society and use of natural resources has associated costs, risks, and benefits.

B. Natural hazards and other geological events have shaped the course of human history at local, regional, and global scales.

C. Sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources, including the development of technologies.

D. Global climate models used to predict changes continue to be improved, although discoveries about the global climate system are ongoing and continually needed.

Science and Engineering Practices

1. Asking questions and defining problems
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations and designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

***SSLs and Outcomes:**

FA = Formally assessed; IA = Informally assessed; ABNA = Addressed but not assessed

I. **Developing the Tools of Thought**

A. Develop automaticity in skills, concepts, and process that support and enable complex thought. FA
   - in labs, homework assignments, projects, quizzes, and tests

B. Construct questions which further understanding, forge connections, and deepen meaning. FA
   -by examining and discussing the work of previous geoscientists and planning and executing term projects

C. Precisely observe phenomena and accurately record findings. FA
   - in specimen-based lab activities and virtual or real field trips

D. Evaluate the soundness and relevance of information and reasoning. FA
   - by reading and discussing papers
   - by evaluating which citations to include in projects and papers

II. **Thinking About Thinking**

A. Identify unexamined cultural, historical, and personal assumptions and misconceptions that impede and skew inquiry. IA
   - by comparing explanations based on early geological theories to explanations based on modern methods

B. Find and analyze ambiguities inherent within any set of textual, social, physical, or theoretical circumstances. FA
   - while integrating multiple lines of geological evidence

III. **Extending and Integrating Thought**

A. Use appropriate technologies as extensions of the mind. FA
   - by using computers to locate resources, view distant areas, and analyze data

B. Recognize, pursue, and explain substantive connections within and among areas of knowledge. FA
   - by integrating prior knowledge of biology, chemistry, and physics in explanations of geological phenomena
   - by examining contributions of geology to our understanding of ecology, evolution, and environmental science

C. Recreate the beautiful conceptions that give coherence to structures of thought. FA
   - by integrating evidence to recreate key geological theories such as plate tectonics and the principles of stratigraphy

IV. **Expressing and Evaluating Constructs**

A. Construct and support judgments based on evidence. FA
   - in labs, homeworks, tests, papers, and projects

B. Write and speak with power, economy, and elegance. IA
   - in papers and projects
   - in Hometown Geology presentation and mini-presentations throughout the semester

C. Identify and characterize the composing elements of dynamic and organic wholes, structures, and systems. FA

- in all aspects of this course, by drawing connections between lithosphere, atmosphere, hydrosphere, and biosphere while explaining geological phenomena

V. **Thinking and Acting with Others**

A. Identify, understand, and accept the rights and responsibilities of belonging to a diverse community. ABNA

- by examining the contributions of diverse scientists to our understanding of geology
- by working in teams with peers

B. Make reasoned decisions which reflect ethical standards, and act in accordance with those decisions. ABNA

- by behaving with intellectual honesty and avoiding plagiarism
- while evaluating the disproportionate impacts of natural hazards on vulnerable communities

Instructional Design and Approach:

Geology is a very hands-on science, and this course takes a corresponding approach. A large part of the course centers around geological problem-solving using real samples and real data (problem-centered). Labs and activities are supported by discussions of varying lengths to cement and integrate key concepts. Students will tackle both classic and unsolved problems in geology to construct an understanding of the Earth System and how Earth processes are reflected in the geologic record. Since geology is a highly interdisciplinary science, students will apply their prior knowledge of chemistry, biology, and physics to their understanding of Earth processes. In the final unit of the course, students will have the option of delving deeper into particular subfields of geology, giving them an opportunity to explore how their existing interests in different fields of science relate to the Earth sciences.

Student Expectations:

1) Late work:

The study of geology is highly cumulative, so you are urged to keep up with assignments and avoid turning in assignments late. You may submit work late with a penalty of 10% each day the assignment is late up to 3 calendar days maximum. Once any assignments are returned to students with grades/comments, this late work will not be accepted. Once the deadline has passed, a zero will be assigned; this zero will be removed once you have turned in the missing assignment.

Computer problems of any kind (including document corruption, hard drive failure, problems with uploading to Google Classroom or Turnitin) will <u>not</u> be treated as acceptable excuses for submitting late work. This being the case, it would be wise to make a backup copy of any computer work that you do for this course, and we suggest ensuring that you've received return receipts in your email from Turnitin. However, if you are having problems getting your work in for any reason, please talk to me!

2) Attendance:
See the IMSA handbook for official attendance policy. If you have a counselor excused absence, or an unexcused absence, you will not be able to make up the missed work. This includes earning a zero on any tests or quizzes given during the missed period.

If you have an excused absence, be sure to contact your teacher to find out what you will miss. If that is not possible, you should see your teacher as soon as possible to discuss your absence. It is **your responsibility** to follow up on what you missed in class.

3) Plagiarism:
Plagiarism is unacceptable and will be dealt with as per IMSA policy on academic dishonesty. Plagiarism includes, but is not limited to, knowingly using another person's work – whether it is a student or a research paper – as your own, improper citations and bibliographic information, improper use of secondary sources, or any other behavior that is deemed dishonest.

Assessment Practices, Procedures, and Processes:
Geology integrates a variety of different kinds of knowledge, and this calls for a diversity of assessment practices. Some aspects of geological knowledge need to be recalled so that they can be efficiently applied in new situations. These aspects can be effectively assessed using quizzes and tests. Other aspects of geological knowledge involve laborious problem-solving and observation. These aspects are more suited for assessment via laboratory activities and projects. In addition, grading lab assignments gives students valuable formative feedback.

Most class days have labs, problems sets, or activities of varying sizes. These activities are intended to be mostly completed in class and may be completed for homework. Homework is only indicated on the calendar if it is distinct from the in-class lab or activity; if you haven't finished a lab by the end of the class period, assume you should finish it for homework. Labs and homework will be sporadically collected and graded.

The first two units end with tests. There are a number of quizzes throughout the second two units, which will be announced at least one week in advance. The second two units culminate in projects. In the first project, students will create a presentation on the geology of their hometown. In the second project, students will work together to apply geology to societal problems.

The course culminates in a cumulative final exam.

Grade breakdown is weighted as follows:

25% homeworks, classwork, and labs
30% tests and quizzes
30% projects
15% final exam

Grading follows the scale:
90% and above = A
80-89% = B
70-79% = C
Below 70% = D