Fall 9-1-2021

GEO 101N.50A: Introduction to Physical Geology

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GEO101 – Introduction to Physical Geology on-line
Fall Semester, 2021

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This course is designed to provide an introduction to Earth as a solid planet, its oceans, and atmosphere, and the interactions of these with Earth's living organisms. This course will provide an overview of the origins and distribution of geologic resources on which human society depends, and it examine some of the most important and consequential relationships humans have with the solid Earth, its oceans, and its atmosphere.

Below is a list of the main **learning objectives** of this course:

1) Understand and be able to describe the materials that make up the solid Earth, including common rock-forming minerals, common rock types, their basic characteristics and geologic settings.
2) Develop an appreciation for and basic working knowledge of geologic time, fossilization, and the tools geologists use to date geologic events.
3) List the major geologic resources, including metallic and non-metallic mineral resources and energy resources. Describe the geologic setting of each and some of the hazards associated with certain mineral resources such as asbestos and mercury.
4) Describe the basic elements of Earth's plate tectonic system. Outline the history of plate tectonic theory; describe the three main plate boundary types.
5) Develop an understanding of Earth's interior structure and the evidence used to infer this structure.
6) Describe how earthquakes occur, what waveforms are involved, and how each waveform travel. Describe how earthquake epicenters are located and how tsunamis form.
7) Understand how volcanoes work and how they differ among different plate tectonic settings in terms of morphology, magma composition, and explosivity.
8) Describe basic geologic structures such as folds and faults and relate each to the type of stress involved. Describe the major tectonic settings and ways in which mountains are formed.
9) Describe how rocks weather and how soils form. Recognize the basic elements of a soil profile and the eleven major soil orders.
10) Understand Earth's fresh water resources, including groundwater, streams, lakes, and wetlands and how these interact. Develop an appreciation for water as a finite resource and some of the socio-political issues surrounding water use today.
11) Describe how glaciers are formed; recognize different glacial erosional landforms and deposits.
12) Describe how deserts are formed; recognize basic desert landforms and understand basic desert processes.
13) Understand how the oceans formed, describe the basic features and sediments of the seafloor, and describe the difference between active and passive continental margins.
14) Describe the composition of ocean water, understand how seawater circulates both at the surface and at depth, recognize emergent vs. submergent coastlines and the basic characteristics of each.
15) Understand the basic structure and composition of Earth's atmosphere, and how both moisture and energy move through and are transformed in the atmosphere.
16) Become familiar with Earth's climate and basic climate zones.
17) Understand the scientific evidence behind climate change; how climate has changed in the geologic past; and what major controls cause climate to change.

Your part in this class:
The biggest challenge with this course will be the volume of information you will be required to assimilate in order to accomplish the course learning objectives. It will be critical for everyone to stay caught up with the course reading.

This course will utilize the e-book *Earth Science: An Introduction* by Marc S. Hendrix (me) and Graham Thompson. The book is also available in hard-copy form via Amazon or cengage.com. The e-book can be purchased directly from cengage.com, and that is how I recommend you obtain a copy of the text.

It took me six years of effort to write and edit the book *Earth Science: An Introduction*, and I wrote the book with this course (GEO101) in mind. Therefore, *Earth Science: An Introduction* will be the main source of content for this on-line course. Although I will post separate lectures that touch on each major topic, the book contains more detail than I will cover in lectures and it will be essentially to have access to the book's content.

To succeed in this class, you must acquire a copy of *Earth Science: An Introduction* and study it carefully. I recommend that you purchase the book immediately and get started right away. The book is organized into chapters with relatively short sections. Each chapter has a review section, a series of key terms that you will need to become familiar with, and a set of review questions that you should use to help assimilate the information.

In addition to the book, each week I will post recorded lectures and powerpoint slides for each lecture. Each lecture will correspond to one of the topics in the syllabus. I will do my best to get each set of lectures up by the beginning of the week. Please pay close attention to the course moodle page where all of the information will be posted.

Course Grading: Your grade for this class will be determined by a set of three midterms and a final exam at the end of the semester. All of the exams are 'closed-book', meaning that once you start the exam you cannot refer to any printed or electronic information to assist you in determining the correct answers.

Each of the three midterm exams will consist of 30 multiple choice questions. The final exam will consist of 60 multiple choice questions. Examples of prior GEO 101 exams by Hendrix will be made available on the course moodle website.

Two optional extra credit assignments are available:
Extra Credit option #1: To earn up to a possible 10% percentage points (which is the difference of 1 full letter grades), you must read the two articles posted at the links below and write a two page (maximum, single-spaced) paper describing your thoughts on these articles, what you learned, and new perspectives gained. Your paper will be scored based on its thoughfulness, creativity, and quality of writing. The optional extra credit assignment will be due on Friday, November 19 by 11:59pm and must be emailed to Hendrix as a pdf file. Note that this deadline is the last Friday before Thanksgiving.

Read first: https://www.newyorker.com/magazine/2019/04/08/the-day-the-dinosaurs-died
Read second: https://www.pnas.org/content/116/17/8190

I strongly recommend that you complete this EC option as early in the semester as you can so as to 'secure' the EC points and also because no EC will be awarded for anything received after the due date.

Extra Credit option #2: To earn up to a possible 5% percentate points (difference of 0.5 full letter grades) you must participate in the class chat that will take place via the course Moodle page. Each week, I will post 2-3 recent news articles that pertain to class. You must read these these articles and engage with the chat. In other words, ask questions, make comments and/or describe any reflections you have as a result of the postings. I will monitor your participation and that will be the basis of my assigning (or not) the 5% extra credit points at the end of the semester.

Questions for the course instructor: As you have questions about this course, please send them to me by email at marc.hendrix@umontana.edu. I will respond to each email within 24 hours. If there is an emergency or you need to contact me urgently, you may use my cell number; otherwise please contact me via email.

Course Schedule:

Here is the day-to-day schedule for the class, including the basic topics covered and chapters in *Earth Science: An Introduction* that you will need to read and study:

WEEK #1:	Course introduction Earth Systems; Rates of change, threshold and feedback effects	Ch.1 – Earth Systems
	Minerals	Ch.2 – Minerals
WEEK #2:	Rock Cycle, Igneous rocks, Sedimentary Rocks, Metamorphic Rocks	Ch. 3 – Rocks
WEEK #3:	Earth history and geologic time, unconformities, absolute geologic time, geologic time scale	Ch. 4 – Geologic Time
WEEK #4: Midterm #1 – Monday, September 20, covers Ch 1-4		
	Minerals and mining Energy Resources, fossil fuels and renewables	Ch. 5 – Geologic Resources
WEEK #5:	Alfred Wegener, continental drift, tectonic plate anatomy; why plates move, plate movement vs. surface topography and climate	Ch. 6: Plate Tectonics
	Earthquake waves, Earthquake damage, Earthquake prediction and mitigation;	Ch. 7: Structure
WEEK #6:	Magma formation and behavior; Plutons and other igneous bodies Volcanoes and volcanic eruptions;	Ch. 8: Magma and Plutons
WEEK #7:	Geologic structures; Tectonic settings of mountains;	Ch. 9: Mountains

WEEK #8: - Midterm #2 – Monday, October 18 Chapters 1-9.

	Mechanical vs. chemical weathering; Soils and soil formation; Mass wasting	Ch. 10: Weathering, Soils, and Erosion
WEEK #9:	Lakes, wetlands; Groundwater; Hot springs and geysers	Ch. 11: Freshwater
	Dams, diversions, and water politics; Water Resources; Water pollution;	Ch. 12: Water Resources
WEEK #10:	Glacial Dynamics; Glacial Erosion; Glacial Deposition; Earth's glaciations	Ch. 13: Glaciers
	How deserts form; wind erosion, landforms associated with deserts; desertification	Ch. 14: Deserts
WEEK #11:	Seafloor; Earth's oceans and their origin; Seafloor features; Continental margins	Ch. 15: Ocean Basins
	Seawater, tides, and ocean currents; Emergent and submergent coastlines	Ch. 16: Shorelines
WEEK #12:	Introduction to Atmosphere Energy and the atmosphere	Ch. 17: Atmosphere Ch. 18: Energy Balance in the Atmosphere

WEEK #13: Midterm #3 – Monday, November 22 - Chapters 1-18

	Atmospheric Dynamics	Ch. 19: Moisture, Clouds, Weather
WEEK #14 Climate		Ch. 20: Climate
WEEK #15: Climate Change		Ch. 21: Climate Change

WEEK #16: Finals week

Final Exam. Final exam will be comprehensive and cover Chapters 1-21.

Final exam must be completed by Friday, December 17, 2021 at 5PM.

STUDENT CONDUCT CODE: Please be familiar with the UM Student Conduct Code. The Student Conduct Code can be found on the Vice President for Student Affairs website: https://www.umt.edu/student-affairs/community-standards/default.php

Course Accommodations (DSS): Students with disabilities will receive reasonable accommodations in this course. To request course modifications, please contact me as soon as possible. I will work with Disability Services in the accommodation process. For more information, visit the Disability Services website (https://www.umt.edu/dss/) or call 406.243.2243 (Voice/Text).