GEOL-2005: Introduction to Geophysics (Spring 2010)

The fundamental goal of this class is to teach you how to introduce the use of physics and mathematics to calculate numeric answers to simple geophysics problems. The topics to be covered are: gravitational fields, isostastic equilibrium, magnetic fields and paleo-magnetism, geothermics and heat flow, elastic wave propagation in the earth, earthquake mechanisms and driving stresses, reflection seismology and oil exploration, and the motion of plates on a sphere relation to geophysical observables. This class has two topical threads: 1) General geophysics that relates to basic physics of our planet which is manifest as plate tectonics; 2) Exploration level geophysics that relates to using geophysics for societal purposes such as oil and mineral exploration.

Class times: MWF 12:00-12:50 Health Science Bldg. Room 462
Lab times: Thus. 1:10-3:00 and 3:10-5:00 Geology Bldg. Room 318.

Instructor: Ken Dueker, Office: ESB 2036, dueker@uwyo.edu, 742-1765, Office hours: MWF 1-2 pm
Teaching Assistant: Jiaming Zhang, Office: ESB 2002, zzhang7@uwyo.edu Office hours: MW 2-3 F 1-2 pm

The textbook for this class is "Looking into the Earth" by Musset and Khan. This course covers eight chapters of your textbook. As part of the GEOL-2000/2005 series classes, a main goal of this course is to teach you to think and calculate answers to quantitative problems. Thus, a primary goal of this class is to teach you to understand the homework problem sets for each of the eight chapters. To facilitate efficient learning, the almost complete homework answer sheets are provided at the start of each chapter. We will have quizzes on the first day of a lecture on a new chapter that count for 5% of your grade: this is to reward you for reading the textbook and studying the online lecture material. The desired outcome for this class is: I desire to teach you how to do the homework problems in the eight textbook chapters and to have you demonstrate an understanding of this material on the four tests. The following mathematics is used: algebra and trigonometry, Pythagorean Theorem, minor use of two-dimensional vectors. Always bring a calculator to class. Use of scientific notation is essential. Knowledge of basic physics and unit analysis is taught. The lectures, homework answer sheets, and textbook scans are at the class website.

http://faculty.gg.uwyo.edu/dueker/GeophysicsClass/

Attendance. No missed homework's or labs or tests can be made up without an official excuse from the Registrars Office.

Grade weighting

Three Non-comprehensive tests and Final	=	10% 10% 10% 20%
Homework	=	30%
Lab reports	=	15%
Chapter quizzes:	=	5%

Tests. Each of the "mid-term" tests is non-comprehensive. The final is comprehensive. Calculators are required. Almost all the exam questions are drawn from the homeworks!

Labs. Labs are a combination of problem sessions and lab assignments. Labs are due at the next lab session.

Homeworks. Homeworks derive from the problems at the back of each textbook chapter plus a few more. The homework's are generally due on the first day that I lecture on the next chapter. The HW solutions are handed out at the start of each new chapter and we work through most of the HW solutions in class lectures and labs. Most all the test questions are drawn from the homework!

Prior class knowledge

During your degree we hope to see your training progress in a temporally coherent manner. This class is half of a two semester required BS Geology degree sequence whose primary goal is to teach a quantitative approach to the physical and chemical processes that operate on our planet. I assume you have had these prior classes:

- Introduction-Geology class (Physical or Historical)
- Geochemical cycles and Earth systems (Chemistry 1 required)
- Stratigraphy and sedimentation
- Passed college algebra/trigonometry University Exam or class(es)
- Also, many of you will have taken (or enrolled in): mineralogy, general physics, calculus-1.

Below is the outline of the year long Geology 2000 and 2005 class sequence that is targeted at the sophomore level.

Geol-2000 class: Geochemical Cycles and Earth systems

- Week 1: Chemical Background
- Week 2: Origin of the Universe and the Solar System, Earth Materials
- Week 3: Systems (Chapters 1 and 2)
- Week 4: The Global Energy Balance (Chapter 3)
- Week 5: That atmospheric circulation system (Chapter 4)
- Week 6: The ocean circulation system (Chapter 5)
- Week 7: The earth circulation system (Chapter 7)
- Week 8: The carbon cycle (Chapter 8)
- Week 9: Ecosystems and Biodiversity (Chapters 9 and 13)
- Week 10: Origin of Life, Effects of Life on the Atmosphere (Chapters 10 and 11)
- Week 11: Long-term climate regulation (Chapter 12)
- Week 12: Pleistocene Glaciations (Chapter 14)
- Week 13: Recent and Present Climate Variability (Chapters 15 and 16)
- Week 14: Hubbert's Peak, Exponential Growth, and the Future Outlook

Geol-2005 class: Introduction to Geophysics

- Gravity and gravitational fields
- Isostatic equilibrium and plate flexure
- Geothermics: convection and heat flow
- Elastic seismic waves propagation
- Seismic waves sampling of earth
- Earthquake stress and seismic wave generation
- Reflection seismology technique and oil exploration
- Magnetic field generation and paleo-magnetism
- Plate motion on a sphere: integration with geophysical constraints

2000/2005 class series skills

Both: unit conversions/ analysis, significant figures, scientific notation, graphs, functions, slopes, area-under-curve, algebra, trigonometry, waves.
2000-class: chemical forces and cycles, equilibrium and steady-state, energy, systems analysis.
2005-class: gravitational force, elastic/viscous stress, magnetic, mass, inertia, energy, temperature, heat, waves.

Undergraduate geophysics (-like) classes to take next year

Oceanography	2010	Holbrook
Remote Sensing	4113	Howell
Hydrology	4444	Zhang
Planetary Geology	4200	Howell
Surface Processes	4880	Reibe
Applied Geophysics	4835	Cheadle
Geodynamics	4217/5217	Cheadle