Earthquakes
GE207 - Spring 2011

Professor Alan Kafka
Department of Earth and Environmental Sciences
Office Hours: M W 1:30-2:30, Devlin 312

Lecture: M W F 12:00-12:50, Devlin 307
Labs: Days and times to be announced

This syllabus provides a basic summary of the course. Other course materials will be posted on the course web site, which is on the BC Blackboard course management system.

Description of Course:

Earthquakes are among the most frightening and devastating of natural hazards, often resulting in catastrophic loss of life and property. Earthquakes are also among the most fascinating of natural phenomena, and analysis of seismic waves generated by earthquakes provides an essential tool for probing the internal structure of our planet. Thus, earthquake seismology is an important component of the science of planet Earth. Although the basic global scale characteristics of earthquakes are well understood in the context of the theory of plate tectonics, considered in detail earthquakes are among the most complex and unpredictable of earth processes.

This course explores earthquake science, including seismology research conducted at Weston Observatory, BC’s geophysical research laboratory. The theory of plate tectonics will be presented as a major foundation of our understanding of earthquake processes. We will explore the properties of seismic waves and how seismic waves generated by earthquakes are used to map the structure of the Earth’s interior. With that understanding of seismology as a background, we will explore what is known about earthquakes, as well as the major unresolved questions that are still being investigated at the forefront of earthquake science, such as: Will it ever be possible to predict earthquakes, and what can be done to mitigate their tragic effects.

This course is part of the Environmental Systems introductory sequence (GE201-208) for Environmental majors and Environmental Studies minors.

Textbooks:

Our Changing Planet (4th Edition) by Fred T. Mackenzie, Prentice Hall, 2011. (Note: This book will also be used in the other Environmental Systems courses.)


Other reading material that may be added will be posted on the course Blackboard web site.
Grades will be based on:

(1) Three Exams (Tentative Dates): February 7, 2011 (25% of course grade); February 25, 2011 (25% of course grade); and March 16, 2010 (Cumulative Final Exam, 30% of course grade).
(2) Laboratory (20% of course grade).

All students are expected to take exams at the scheduled time unless they have a medical excuse signed by their Dean. Notification prior to any exam being missed is required in order for a makeup exam to be given.

Lecture Outline: Below is a tentative list of topics that will be covered this semester. In addition to these topics, we will also explore specific earthquakes of interest throughout the course. Additions and changes to topics and readings will be posted on the course Blackboard web site.

- Seismic Waves
- Seismology and the Earth’s Interior
- The Theory of Plate Tectonics
- Earthquakes and Plate Boundaries
- Earthquake Locations
- Earthquake Faulting Processes
- Earthquake Depths
- Earthquake Magnitude and Seismic Moment
- Earthquake Hazards
- Earthquake Prediction

Academic Integrity:

Boston College values the academic integrity of its students and faculty. It is your responsibility to familiarize yourself with the university’s policy on academic integrity, which can be found at www.bc.edu/offices/stserv/academic/resources/policy.html#integrity. Violation of academic integrity will be reported to your class dean and judged by the academic integrity committee in your school. If you are found responsible for violating the policy, penalties may include a failing grade as well as possible probation, suspension, or expulsion, depending on the seriousness and circumstances of the violation.

Schedule of Topics, Readings and Labs:

A preliminary schedule of class topics, readings and labs is listed on the next page. However, life (and earthquakes) are uncertain. In fact, it is quite possible that a large and interesting earthquake will occur somewhere on planet Earth during time of this course. Thus, the schedule of topics, readings and labs will evolve, and other readings will likely be added to this list. The order of class topics and readings may also change as the course develops.

Students are responsible for knowing all of the information in this syllabus. There may be corrections or addenda to what is written here, and if so they will be posted on the course Blackboard web site. The most current version of syllabus will always be the version on the web.
<table>
<thead>
<tr>
<th>(Week) Dates</th>
<th>Topics</th>
<th>Reading*</th>
<th>Lab</th>
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</table>
| (1) 1/19, 1/21 | * Introduction  
* Seismic Waves | * Mackenzie, Ch. 1, Ch. 9 (p. 214-217)  
* Bolt, Ch. 1 | No lab |
| (2) 1/24, 1/26, 1/28 | * Seismic Waves (continued)  
* Seismology and the Earth’s Interior | * Mackenzie, Ch. 2 (p. 12-19), Chapter 9 (p. 217-221)  
* Bolt, Ch. 2, Ch. 3 and Ch. 6 | Exploring What Your Seismograph Records |
| (3) 1/31, 2/2, 2/4 | * The Theory of Plate Tectonics | * Mackenzie, Ch. 3, Ch. 9 (p. 221-228)  
* Bolt, Chapter 5 | Earthquake Tracking |
| (4) 2/7 (Exam #1), 2/9, 2/11 | * Earthquakes and Plate Boundaries | * Mackenzie, Ch. 9 (p. 228-235)  
* Bolt, Ch. 4 | Locating Earthquakes |
| (5) 2/14, 2/16, 2/18 | * Earthquake Locations and Faulting Processes | * Mackenzie, Ch. 9 (p. 235-238) | Scale Model of Earth’s Interior |
| (6) 2/21, 2/23, 2/25 (Exam #2) | * Earthquake Depths  
* Magnitude and Seismic Moment | * Mackenzie, Ch. 9 (p. 238-246)  
* Bolt, Review Ch. 4 | Earthquake Ground Motion and Effects on Buildings |
| (7) 2/28, 3/2, 3/4 | * Earthquake Hazards | * Mackenzie, Ch. 9 (p. 246-254)  
* Bolt, Chapter 7 | Student Presentations |
| (8) 3/14, 3/16 (Final Exam) | * Earthquake Prediction | * Mackenzie, Ch. 9 (p. 254-257)  
* Bolt, Ch. 8 | Student Presentations |

* Other reading material that may be added, and/or changes to this reading schedule will be posted on the course Blackboard web site.