Fall 2004 **GEOL 410/510** Fault Mechanics (CRN 15255/15256)
Meeting Times: Mon. and Wed., 12-1:20 pm,
Location: 202 Cascade Hall

Instructor: Prof David Schmidt **E-mail:** das@uoregon.edu
Office: 210C Cascade Hall **Phone:** 346-3005

Required Prereqs: GEOL 201/202 or equivalent, MATH 253
Recommended Prereq: GEOL 325 (Geophysics), 350 (Structure), 353 (Hazards), or 450 (Field camp)

Course Description: Fault mechanics is the study of the physical processes that occur on active fault systems. The field of fault mechanics seeks to better understand the factors that dictate how faults behave over various time scales. We will explore the physics of faulting at the spatial scale of the fault surface up to the length of plate boundary faults. Topics that will be addressed include fault friction, earthquake scaling laws, the processes leading up to and following seismic rupture, earthquake triggering, shear heating, and the factors that control aseismic faulting.

Course Objectives: This course is designed to help students with the transition from textbook knowledge to real-world application and scientific discovery. The assigned reading represents a collection of book chapters and review articles written by leading scientists who study the mechanics of faulting. The reading will expose students to the level of scientific discourse found in research-grade literature and introduce the students to cutting-edge research in the discipline. The course project will assist students in developing their critical thinking skills, as well as their oral and written communication skills. In the end, this course will hopefully provide students with a better understanding of the successes and challenges in the study of active faults.

Course Format:
This course will combine both a lecture and seminar format. The first part of each meeting period will consist of a lecture on the important concepts. The second part will consist of a group discussion on the assigned reading. Students are expected to have completed the assigned reading prior to each class period so as to participate in the group discussion.

Required Reading Materials:
All students: Course packet available at the bookstore.
Graduate students: Additional readings are available in my office.

Recommended Reading:
The Mechanics of Earthquakes and Faulting, C. H. Scholz, Cambridge University Press; 2nd edition, 2002 ($47 at amazon.com)
Faulting in brittle rocks: an introduction to the mechanics of tectonic faults, G. Mandl, Springer, 2000
The complex faulting process of earthquakes, J. Koyama, Kluwer 1997

Field Trip: Optional trip to Mitchell, Oregon. (Date: Oct 9-10?)

Class Project (Required for 4 credit enrollees):
Students will perform a mini-research project related to the theme of the course. A list of possible projects will be handed out later in the course, although students are encouraged to propose projects of interest. The research topic must be approved by the instructor. Project proposals (~1 page in length) are due on Monday, Oct. 25. A rough bibliography will be due in the following weeks. Each student will give a 15 minute presentation to the class during the last week of the course highlighting their results. A first draft of the report will be due ahead of the presentations for students to receive feedback and suggestions on their writing. The final written report (~6 pages of text plus figures and bibliography; ~8 pages for graduate students) is due the day of the final exam.

Project Timeline			
Proposal Due	Oct 25	First draft of Report	Nov 24
Bibliography Due	Nov 8	Presentation	Nov 29
		Final Report Due	Dec 9

Course Outline (tentative):

Sept 27/29	Anatomy of Faults, Rheology	
Oct 4/6	Aseismic Faulting, Earthquake Cycle	
Oct 11/12	Fault Friction	
Oct 18/20	Catch-up, Midterm	
Oct 25/27	Earthquake Dynamics	
Nov 1/3	Heat Flow Paradox, Fault Strength	
Nov 8/10	Fault Fluids, Microseismicity	
Nov 15/17	Catch-up, Midterm	
Nov 22/24	Earthquake Triggering, Prediction (Thanksgiving Vacation)	
Nov 29/Dec 1	Project Presentations and Wrap-up	
Dec 9	Final Exam/Reports Due	10:15 am

Grading:	3 cr. Option	4 cr. Option
Participation:	5%	5%
Homework:	10%	10%
Midterm 1:	25%	25%
Midterm 2:	25%	25%
Comprehensive Final:	30%	□
Presentation Eval:	5%	□
Project Proposals:	□	5%
Project Presentation:	□	10%
Project Report:	□	20%

Students who score 80% or higher will be guaranteed an **A**, 65% or higher a **B**, 50% or higher a **C**, etc. Final grades will be based on a curve if class performance falls below the above-mentioned scale. Late work will not be accepted unless delayed due to extenuating circumstances.