



Course Syllabus: Seismotectonics - ErSE 217

Division	Physical Science and Engineering Division
Course Number	ErSE 217
Course Title	Seismotectonics
Academic Semester	Spring
Academic Year	2017/2018
Semester Start Date	01/28/2018
Semester End Date	05/24/2018
Class Schedule (Days & Time)	02:30 PM - 04:00 PM Sun Wed

Instructor(s)

Name	Email	Phone	Office Location	Office Hours
Sigurjon Jonsson	sigurjon.jonsson@kaust.edu.sa	+966128080291		To be determined.

Teaching Assistant(s)

Name	Email
------	-------

Course Information

Comprehensive Course Description	<p>In this course we discuss the relationship between tectonics and earthquakes. We begin by going through some basics in continuum mechanics, discuss different earth rheologies and how material fails. Fault friction and fault mechanics are among the topics, as well as the conditions for stable and unstable sliding. We will go through representations of earthquake sources, such as finite fault models and moment tensors and how such information can be used in earthquake hazard analysis. We will discuss earthquake interaction and Coulomb failure stress change calculations. In addition, earthquake cycles will be discussed, not only the earthquakes themselves, but also interseismic deformation and post-seismic processes and deformation. Related topics like slip transients and earthquake swarms, as well as earthquake scaling and statistics will be covered as well. Finally, slip rate determination, seismic hazard assessments and paleoseismology will be discussed.</p> <p>We expect to have guest lectures on earthquake geology and paleoseismology from an outside collaborator and also on lacustrine paleoseismology. In addition, the students taking the course will likely spend one day at an international conference in Jeddah in February. Finally, we expect to have one field trip as a part of the course, lasting 2-4 days.</p> <p>To get familiar with the course topics we will have 4-5 homework exercises, a midterm, and 1-2 student presentations during the course. The grading will be based on the performance in these activities and there will be no final exam.</p> <p>Note: As pre-requisite requirement it says "ErSE 204 Geophysical Continuum Mechanics or consent with instructor". This information is outdated, as ErSE 204 is not offered anymore. There are no pre-requisite requirements anymore, instead, we will have a bit more thorough introduction.</p>
Course Description from Program Guide	Stress and strain, tensor analysis, rheology, brittle vs. ductile deformation, fracture, fault mechanics, friction, stable and unstable sliding, double-couple representation of earthquake sources, moment tensors, coulomb failure stress changes, earthquake triggering, stress drop, Kostrov's summation, comparative seismotectonics.

Goals and Objectives	<p>By the end of the course, students are expected to</p> <ul style="list-style-type: none"> -understand stresses and strain in the crust and be able to resolve stresses on faults, apply coordinate transformations and assess failure criteria -know the behavior of materials and faults in the crust under different conditions -know how to interpret focal mechanisms and moment tensors in seismotectonics -be able to derive information for seismic hazard assessment of an area, when provided with basic geological and geophysical data
Required Knowledge	<p>Along with general geology and geophysics knowledge, some insights into continuum mechanics and seismology concepts are needed, as well as basic knowledge of Matlab. Please consult with instructor if further information is needed.</p>
Reference Texts	<p>Stein and M. Wysession, An introduction to seismology, earthquakes and earth structure, Blackwell Publishing, Malden, USA, (2003).</p>
Method of evaluation	<p>10.00% - Attendance and Participation 30.00% - Oral presentation 30.00% - Midterm exam 30.00% - Homework /Assignments</p>
Nature of the assignments	<p>There will be 4-5 problem sets during the semester, one midterm exam, and 1-2 student presentations.</p>
Course Policies	<p>Students are expected to turn in all assignments, attend the midterm, and give 1-2 oral presentations during the semester.</p>
Additional Information	

Tentative Course Schedule

(Time, topic/emphasis & resources)

Week	Lectures	Topic
1	Sun 01/28/2018	Introduction
1	Wed 01/31/2018	Stress and strain
2	Sun 02/04/2018	Visit to the International Geoscience Conference in Jeddah
2	Wed 02/07/2018	More on stress and strain, principal stresses, normal and shear stresses
3	Sun 02/11/2018	More on stress and strain, tensor coordinate transformations
3	Wed 02/14/2018	Elastic, viscous and viscoelastic rheologies
4	Sun 02/18/2018	Brittle and ductile failure
4	Wed 02/21/2018	Frictional sliding, Mohr's circle for fracture and friction, fluid effects on failure
5	Sun 02/25/2018	Anderson's theory on faulting, stable and unstable sliding
5	Wed 02/28/2018	Earthquake geology and paleoseismology (guest lecture)
6	Sun 03/04/2018	Earthquake geology and paleoseismology (guest lecture)
6	Wed 03/07/2018	Lacustrine paleoseismology (guest lecture)
7	Sun 03/11/2018	Lacustrine paleoseismology (guest lecture)
7	Wed 03/14/2018	Earthquake mechanics and moment tensors
8	Sun 03/18/2018	Earthquake mechanics and moment tensors
8	Wed 03/21/2018	Earthquake scaling and size
9	Sun 03/25/2018	Stress drop and Kostrov's summation
9	Wed 03/28/2018	Coulomb failure stress changes
10	Sun 04/01/2018	Spring break
10	Wed 04/04/2018	Spring break
11	Sun 04/08/2018	EGU in Vienna (maybe a guest lecture)
11	Wed 04/11/2018	EGU in Vienna (maybe a guest lecture)
12	Sun 04/15/2018	Earthquake cycles and deformation
12	Wed 04/18/2018	Interseismic deformation
13	Sun 04/22/2018	Postseismic processes and deformation
13	Wed 04/25/2018	Fault slip transients, stable fault sliding
14	Sun 04/29/2018	Slip rate determination
14	Wed 05/02/2018	Earthquake statistics
15	Sun 05/06/2018	Earthquake hazard assessments
15	Wed 05/09/2018	Probabilistic seismic hazard assessments (PSHA)
16	Sun 05/13/2018	Student presentations
16	Wed 05/16/2018	Student presentations
17	Sun 05/20/2018	Final exam week (There is no final in ErSE 217)
17	Wed 05/23/2018	Final exam week (There is no final in ErSE 217)

Note

The instructor reserves the right to make changes to this syllabus as necessary.