



Course Syllabus: Seismology II - ErSE 310

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| Division | Physical Science and Engineering Division |
| Course Number | ErSE 310 |
| Course Title | Seismology II |
| Academic Semester | Spring |
| Academic Year | 2017/2018 |
| Semester Start Date | 01/28/2018 |
| Semester End Date | 05/24/2018 |
| Class Schedule (Days & Time) | 10:30 AM - 12:00 PM Mon Wed |

| Instructor(s) | | | | |
|-----------------------|---------------------------|---------------|----------------------------------|---|
| Name | Email | Phone | Office Location | Office Hours |
| Paul Martin Mai | martin.mai@kaust.edu.sa | +966128080266 | 3114, 1, Al-Khawarizmi (bldg. 1) | office hours will be held based on student's needs and requests |
| Daniel Bernhard Peter | daniel.peter@kaust.edu.sa | | 0146, 1, Al-Khawarizmi (bldg. 1) | office hours based on student's needs & requests |

| Teaching Assistant(s) | |
|-----------------------|-------|
| Name | Email |
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| Course Information | |
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| Comprehensive Course Description | The course provides an introduction to global seismology and earthquake physics, and consists of two parts. Part I: Whole Earth wave propagation (body waves, surface waves, normal modes); imaging Earth 3D structure with ray-based methods; introduction to methods beyond ray-theory; attenuation and scattering of seismic waves. Part II: Earthquake source mechanics; earthquake kinematics and scaling laws; earthquake dynamics, fracture modes and crack propagation; introduction to probabilistic seismic hazard assessment. Throughout the semester, students work in teams towards a term project, with intermediate discussion sessions and short reports leading up to a final project report and presentation. |
| Course Description from Program Guide | The course provides an introduction to global seismology and earthquake physics, and consists of two (2) parts. Part I: Whole Earth wave propagation (body waves, surface waves, normal modes); imaging Earth 3D structure with ray-based methods; introduction to methods beyond ray- theory; attenuation and scattering of seismic waves. Part II: Earthquake source mechanics; earthquake kinematics and scaling laws; earthquake dynamics, fracture modes and crack propagation; introduction to probabilistic seismic hazard assessment. Throughout the semester, students work in teams towards a term project, with intermediate discussion sessions and short reports leading up to a final project report and presentation. |
| Goals and Objectives | After taking this course, students will have the background knowledge necessary to start original research in global seismology and earthquake source studies. |
| Required Knowledge | Basic knowledge of seismic wave propagation, partial differential equations and linear algebra. |

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| Reference Texts | <p>Aki, K. and P. G. Richards, <i>Quantitative Seismology</i>, second edition, University Science Books, Sausalito, 2002.</p> <p>Dahlen, F. A. and J. Tromp, <i>Theoretical Global Seismology</i>, Princeton University Press, Princeton, 1998.</p> <p>Stein and Wysession, <i>An Introduction to Seismology, Earthquakes, And Earth Structure</i> - Blackwell - 2003</p> <p>Shearer, P., <i>Introduction to Seismology</i>, Cambridge University Press, 1999.</p> |
| Method of evaluation | <p>20.00% - Oral presentation</p> <p>20.00% - Written report</p> <p>30.00% - Homework /Assignments</p> <p>30.00% - Course Project(s)</p> |
| Nature of the assignments | <p>(1) regular home works to review the material and expand its understanding; these may require some programming and written assignments;</p> <p>(2) student project, to be conducted in teams of 2 students working on a dedicated subject, and presenting the results as a report and a ~30 min presentation to the class</p> |
| Course Policies | <p>+ late submission of a homework result in a penalty due to late submission, and may be accepted only if prior notification is given to the instructor</p> <p>+ absences should be indicated to the instructor at least two days prior to class; if this is not possible (due to illness), contact instructor as soon as possible after the missed class</p> |
| Additional Information | n/a |

Tentative Course Schedule

(Time, topic/emphasis & resources)

| Week | Lectures | Topic |
|------|----------------|--|
| 1 | Mon 01/29/2018 | Introduction to and History of Global Seismology |
| 1 | Wed 01/31/2018 | Betty's theorem and representation theorem |
| 2 | Mon 02/05/2018 | Body waves, part 1 |
| 2 | Wed 02/07/2018 | Body waves, part 2 |
| 3 | Mon 02/12/2018 | Surface waves, part 1 |
| 3 | Wed 02/14/2018 | Surface waves, part 2 |
| 4 | Mon 02/19/2018 | Normal modes, part 1 |
| 4 | Wed 02/21/2018 | Normal modes, part 2 |
| 5 | Mon 02/26/2018 | Seismic ray theory |
| 5 | Wed 02/28/2018 | Finite frequency seismology |
| 6 | Mon 03/05/2018 | Earthquake source theory, part 1 |
| 6 | Wed 03/07/2018 | Earthquake source theory, part 2 |
| 7 | Mon 03/12/2018 | Earthquake source kinematics, part 1 |
| 7 | Wed 03/14/2018 | Earthquake source kinematics, part 2 |
| 8 | Mon 03/19/2018 | Earthquake source dynamics, part 1 |
| 8 | Wed 03/21/2018 | Earthquake source dynamics, part 2 |
| 9 | Mon 03/26/2018 | Near-source ground-motion prediction |
| 9 | Wed 03/28/2018 | Near-source ground-motion simulation |
| 10 | Mon 04/02/2018 | Spring Break, no class |
| 10 | Wed 04/04/2018 | Spring Break, no class |
| 11 | Mon 04/09/2018 | Seismic hazard assessment, part 1 |
| 11 | Wed 04/11/2018 | Seismic hazard assessment, part 2 |
| 12 | Mon 04/16/2018 | Attenuation of seismic waves in complex media |
| 12 | Wed 04/18/2018 | Seismic scattering in complex media |
| 13 | Mon 04/23/2018 | Diffuse seismic wavefields |
| 13 | Wed 04/25/2018 | Ambient noise seismology, part 1 |
| 14 | Mon 04/30/2018 | Ambient noise seismology, part 2 |
| 14 | Wed 05/02/2018 | Ambient noise seismology, part 3 |
| 15 | Mon 05/07/2018 | Numerical methods in global seismology, part 1 |
| 15 | Wed 05/09/2018 | Numerical methods in global seismology, part 2 |
| 16 | Mon 05/14/2018 | Student project presentations |
| 16 | Wed 05/16/2018 | Student project presentations |
| 17 | Mon 05/21/2018 | Exam period |
| 17 | Wed 05/23/2018 | Exam period |

Note

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