GEOL 214: Active Tectonics – SYLLABUS

**Instructor:** Dr. Mike Oskin, 3123 Earth and Physical Sciences. meoskin@ucdavis.edu

**Location:** Online, Tuesday-Thursday 10:30-11:50am.

**Synopsis:** Active Tectonics is lecture, project, and problem-set based course on tectonic processes taught through the lens of active systems. The course examines the interplay of tectonics and surface processes through observations, quantitative analytical, and modeling techniques. The course is arranged into four parts, each with an associated problem set. We will also work on two group projects - setting up a landscape evolution model with a fault boundary condition, and mapping surface ruptures from the 2019 Ridgecrest Earthquake. We will be using several open-source computational tools in this course: QGIS, R, and Python.

**Textbook:** We will be using excerpts and figures from Burbank, D., and Anderson, R., *Tectonic Geomorphology, 2 ed.* (2012). Purchase of this book is highly recommended for those interested in exploring the topics in this course in more depth.

**Office hours:** TBD

**Grading & Due Dates**

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Problem Sets</td>
<td>60%</td>
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<tr>
<td>Class Projects &amp; Field Trip</td>
<td>20%</td>
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<tr>
<td>Class Participation</td>
<td>5%</td>
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<td>Final Exam</td>
<td>15%</td>
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**Problem Sets:** Problem sets emphasize quantitative problem solving in structural geology, tectonics, geomorphology and Quaternary geochronology. A late problem set will lose one half letter grade per day. There will be four problem sets, each worth 15% of your grade.

**Class Projects:** Class projects involve a mix of group- and individual efforts to explore a problem. This year we will be working on two projects. First, we will set up and explore landlab, an open-source tool for landscape evolution modeling. Individual efforts will focus on setting up boundary conditions and running models for various active tectonic scenarios. The second project will be mapping of the 2019 Ridgecrest Earthquake rupture using high-resolution topography and imagery data. Individual efforts will focus on various segments of the rupture. Each individual project effort is worth 10% of your grade.

**Field Trip:** No formal field trip this year due to the pandemic. Informal (no credit) local field trip(s) will be arranged.
**Participation:** Participation includes asking questions, participating in discussions, group project effort, and all around being engaged in the course.

**Final Exam:** The final exam will focus on the materials taught in the course, especially the quantitative analysis tools addressed in the problem sets.

**Schedule (tentative)**

Part 1. Stress in the lithosphere
- Lecture 1: Force and Stress, Mohr-Coulomb Mechanics
- Lecture 2: Friction, pore pressure, brittle fault strength
  (no lecture January 12)
- Lecture 3: Heat flow, heat conduction, geothermal gradient, plasticity, lithospheric strength

Part 2. Geomorphology concepts and models
- Lecture 4. Hillslopes, bedrock rivers, and scarp diffusion
- Lecture 5 Geomorphic markers
- Lecture 6. Introduction to Landlab
  (no lecture January 28)

Part 3. Convergent Systems
- Lecture 7. Force balance, topography, and lithospheric flexure
- Lecture 8. Fault-related folding
- Lecture 9. Coulomb wedge theory

Part 4. Quaternary Chronology
- Lecture 10. Thermochronology and rates of exhumation
- Lecture 11. Cosmogenic isotopes, rates of erosion
- Lecture 12: Quaternary geochronology, paleoseismology
- Lecture 13: Individual presentations / Landlab

Part 5. Transform Systems
- Lecture 14: Strike-slip faulting and fault-zone geomorphology
- Lecture 15: Ridgecrest earthquake, and Introduction to QGIS

Part 6. Rift Systems
- Lecture 17: Normal fault systems, wide and narrow rifts, subsidence and uplift
- Lecture 18: Extra topics / overflow