ESS 411/511 Geophysical Continuum Mechanics
Syllabus Autumn 2021

Instructors:

Brad Lipovsky
email: bpl7 at uw.edu
Office: ATG 218

Ed Waddington
email: edw at uw.edu
Office: ATG 715

Office Hours: by arrangement

Course description

Continuum mechanics describes how internal and boundary forces can affect and change the interiors of bodies.

Conservation laws and constitutive relations allow us to apply continuum concepts to studies of the Earth. In this class, we use Cartesian tensors to describe stress and strain, strain rate, and other continuum behaviors such as thermal response. For more details, see the Schedule page.

Continuum mechanics was developed in the nineteenth century and is a fundamental underpinning of many fields of study besides the Earth Sciences. (For example, extracting a wine-bottle cork involves stress, strain, and constitutive relations.)

Meetings

Lectures	M-W-F	10:30 – 11:20	JHN 170
Problem sessions	Th	1:30 – 2:50	JHN 170

Grading policy

Grades in ESS 411 will be based on homework solutions (50%), the final exam (20%), the mid-term (20%), and class participation (10%).
In 511, grades will be based on the same items, with the addition of the term project. Weights for the exams and participation will be the same, but homework will count for 40% and the final project for 10% of the final grade.

ESS 511 Term project

Each 511 participant will investigate a topic involving some aspect of continuum mechanics. Ideally it can be helpful to your research program. You will make an AGU/GSA-style 12-minute oral presentation of your results at 8:30 on Monday morning December 13, when we would otherwise be scheduled for a final exam (the final will be a take-home). You will also turn in a written report in the style and length of a short paper in *Geology* or *Geophysical Research Letters.*

Readings

G.T. Mase, R.E. Smelser, and G.E. Mase, 2009. *Continuum mechanics for engineers.* Third edition. CRC Press. ISBN: 978-1-4200-8538-9
Text is available online through UW libraries
https://ebookcentral-proquest-com.offcampus.lib.washington.edu/lib/washington/detail.action?docID=1446640.
Other reading assignments will be available on-line through the Reading Materials page (on

left side of webpage).

Rudnicki, J.W., *Fundamentals of continuum mechanics*, Wiley, 2015.

Supplementary books:

Turcotte, D.L. and G. Schubert. 2002. *Geodynamics: applications of continuum physics to geological problems.* Second edition. Wiley.

We may do some occasional reading and problems from this book. The appropriate sections will be made available as needed.

Tests

There will be a timed take-home midterm and a timed take-home final exam.

Class participation

One student will volunteer to write a one-paragraph report at the start of each class, on the key take-away message from the previous class. The volunteer will turn in the written report and give an oral report of 90 seconds or less, when we meet next. (The goal is not to give a synopsis of all the developments during the class, but rather to ***extract just the key ideas***.)

Participants are encouraged to work together on assignments and in study sessions, but each participant should then write up his or her own answers or homework and tests in their own words.

We encourage questions and discussions during class if points are unclear.

Disability-related Needs

To request academic accommodations due to a disability, please contact Disability Resources for Students (DRS) 011 Mary Gates Hall

uwdrs@uw.edu

206-543-8924 (Voice), 206-543-8925 (TTY), 206-616-8379 (FAX).

If you have a letter from DRS, please present the letter to the coordinating instructor so that he or she can discuss with you the accommodations that you might need in this class.

Academic Integrity

At the University level, passing off anyone else's scholarly work (which can include written material, exam answers, graphics or other images, and even ideas) as your own, without proper attribution, is considered to be academic misconduct. ***For example, cutting and pasting text from a web site and submitting it as your own work is plagiarism, and repeat offenses can lead to dismissal from the university.***

Plagiarism, cheating, and other misconduct are serious violations of the University of Washington **Student Conduct Code** (WAC 478-120).

http://www.washington.edu/cssc/for-students/student-code-of-conduct/

We expect that you will know and follow the university's policies on cheating and plagiarism. Any suspected cases of academic misconduct will be handled according to University of Washington regulations. For more information, see the University of Washington **Community Standards and Student Conduct** website. http://www.washington.edu/cssc/

Please also review the College of the Environment **Academic Misconduct Policy**.

http://coenv.washington.edu/intranet/academics/academic-policies/academic-misconduct/

Religious Accommodations
Washington state law requires that UW develop a policy for accommodation of student absences or significant hardship due to reasons of faith or conscience, or for organized religious activities. The UW's policy, including more information about how to request an accommodation, is available at Religious Accommodations Policy (https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/). Accommodations must be requested within the first two weeks of this course using the Religious Accommodations Request form (https://registrar.washington.edu/students/religious-accommodations-request/)