GEOL 3310 — Structural Geology and Tectonics

COURSE OVERVIEW

An introductory course in structural geology. The geologic record of stress and strain are emphasized through quantitative and kinematic analyses. The laboratory is an integral part of the course which includes strain analysis, experimental rock deformation, descriptions of structural features (folds, faults, shear zones), and map pattern / orientation analysis to unravel polyphase deformation. Readings introduce students to modern techniques and new scientific discoveries, promoting scientific literacy.

The course includes **3 hours of lectures**, a **2 hour laboratory** exercise every week, and a one-day **fieldtrip**.

Textbook:
Fossen, H. (2016). *Structural geology* (2nd ed.). Cambridge University Press. Price: $84.95

Instructor: Dr Tobias Stephan
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Office hours: Wed 1–3 pm

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Class Schedule: Lectures: Tue & Thu 2:30–4:00 pm (CB-3031)
Labs: Mon 2:30–4:30 pm (CB-3031)

Grading: Midterm 30 %
Final 25 %
Labs 30 %
Field Trip 10 %
In-Class Participation 5 %

TENTATIVE CLASS SCHEDULE

Week	Subject	Chapter
	PART A – FUNDAMENTALS	
1	Introduction	1
1	Orientation Analysis	Appendix
2	Strain	2–3
3	Stress	4–5
4	Rheology	6
	PART B – BRITTLE STRUCTURES	
4	Brittle Fractures	7
5	Joints and Veins	8
6	Faults	9
6	Paleo-Stress	10
	PART C – DUCTILE STRUCTURES	
8	Shear Zones	13–16
9	Folds	12
10	Deformation Mechanisms	11
	PART D – TECTONICS	
11	Contractional Tectonics	17
12	Extensional Tectonics	18
13	Strike-Slip and Oblique Regimes	19
14	Synthesis	22

TECHNOLOGY GUIDELINES

- *Note taking*: Please take notes on paper rather than on a laptop — I make a lot of drawings on the board. Talk to me in person if you really want to use a device. No photographs of the board are allowed unless you ask permission.
- *Calculators*: It would be better if you use a real calculator rather than your phone (because phones are not going to be allowed, see below). Calculators must comply with the faculty of engineering's calculator policy.
- *Phones*: We're going to try an experiment this term: **No phones**. At all. Ever. (Meaning I never want to see one out.) The labs can be quite challenging and I want you to be able to focus extended periods of time. You can use a computer if you need a calculator during lab.
- Note: No photographs of the board.

CLASS PARTICIPATION

Class participation (and obviously attendance) is expected for all class and lab meetings. If you are too ill to attend class, please send me an email prior to class (if possible). Group work is common in class. Be prepared to work with different people—this is a life skill.

LABS

There are 9 labs during the semester. Each lab assignment contains two parts:

- Initial submission – due at the end of the lab session
- Correction – due at the beginning of the following lab.

Late labs will be penalized *10 % per day* and will not be accepted more than *one week past the due date*. Comments

to be adressed in the correction are typically returned within 2–3 days after initial submission.

Tentative lab schedule

1 Stereographic projections
2 Strain analysis
- Field trip post-processing
3 Stress in rocks
4 Prada deformation experiments
5 Faulting and fracturing
- Midterm review and Q&A session
6 Paleostress analysis
7 Strain in shear zones
8 Balanced cross-sections
9 Plate motion

EXAMS

The midterm exam will a written exam. *Note*: All materials from the course including lectures, readings, and laboratories are testable materials for the midterm exams. Calculators are not required for the exam, though basic maths (addition, subtraction, multiplication) may be necessary.

For the **final exam**, students will research a topic in structural geology and/or tectonics and give a presentation of approximately *10 minutes*. Topics will be randomly assigned shortly after the midterm exam. The presentation will be followed by a *10-min discussion* to assess both the student's understanding of the topic and their broader knowledge of structural geology and tectonics.

FIELD TRIP

The course includes a mandatory one-day field trip (20th September, 9 am – 5:30 pm). The goal of this field trip is to make detailed descriptions of rocks along a transect across western Superior Province. This includes (i) developing skills for making rock descriptions in the field, (ii) practicing the compass and plotting structural measurements, and (iii) quantifying deformation. The student will deliver their field notes alongside a drafted tectonic map, diagrams and results of the orientation and deformation analysis, and a brief interpretation of the geology. Submission due is a week after the field trip.

ACADEMIC INTEGRITY

Standard rules of academic integrity apply to all assignments. Namely, your work should be your own. If you solve problems with other students, please list their names and explain the nature of your collaboration. Please review the University's webpage about academic integrity incl. plagiarism. No ChatGPT or other generative AI will be necessary for this class. So don't use them.

Last updated: December 1, 2025