EESC37H3 S Structural Geology

Winter 2024 Syllabus

Course Meetings

Section	Day & Time	Delivery Mode & Location
LEC01	Tuesday, 12:00 PM - 2:00 PM	In Person: EV 222
PRA0001	Tuesday, 2:00 PM - 5:00 PM	In Person: EV 224

Refer to ACORN for the most up-to-date information about the delivery and location of the course meetings.
Prerequisites: [PHYA10H3 or PHYA11H3] and EESB15H3 and EESB20H3
Credit Value: 0.5

Course Contacts

Instructor: Dr, Heidi Daxberger. **Email:** heidi.daxberger@utoronto.ca
Office Hours and Location: Monday 11 - 11.45 am
Teaching Assistant: Yulong Kuai

Course Overview

The course introduces mechanics of rock deformation. It examines identification, interpretation, and mechanics of faults, folds, and structural features of sedimentary, igneous and metamorphic rocks as well as global, regional and local scale structural geology and tectonics. Lectures are supplemented by lab exercises and demonstrations as well as local field trips.

Overview:

Structural geology is the study of the deformation structures in Earth's lithosphere. Structures such as folds, faults, mineral fabrics, and the respective patterns occur at a variety of scales and lead to changes in shape and geometry of rocks. Deformation description and various approaches in 'Structural analysis' will be covered in this course:

- Geometric analysis – analysis of the geometry (patterns, shapes and mineral fabrics) of primary structures acquired while the rock was being deposited or emplaced, and secondary structures produced by subsequent deformation
- Kinematic analysis – analysis of the displacement and movements that lead to shape changes (deformation = strain) of rock bodies
- Mechanical and dynamic analysis – reconstruction of forces (stress e.g. magnitude, direction, duration) that led to deformation within a rock body

These help to describe deformation structures, delineate deformation conditions, better understand deformation and processes such as plate tectonics.

Overall, the course is expected to contribute to inferring deformation processes from observed geologic structures and to decipher the long processes based on the geologic record our planet holds. This bears not only on unravelling geodynamic processes, which have shaped the Earth's crust, but also on understanding the formation of the natural resource deposits.

Course Learning Outcomes

The objective of this course is to introduce students at a beginner to intermediate level to the fundamentals of structural geology and structural analysis. At the end of the course, you can:

- use a compass to take structural geologic measurements
- construct and interpret geologic maps and cross sections
- describe and analyse geologic structures and infer related kinematics and dynamics
- explain the fundamentals of the mechanics of brittle and ductile deformation of rocks
- identify and interpret of geologic structures in the field
- infer rock forming and altering processes.
- use your spatial skills to interpret subsurface structures based on given geologic information

Reading Materials:

Recommended: Structural Geology – 2nd Ed., 2016, H. **Fossen**, Cambridge Univ. Press

Needed (download): An introduction to geologic structures and maps, Bennison et al., Routledge,

8th edition, Free download through UTSC library - Online Course Reserve (quercus link).

Plate Tectonics – Continental Drift and Mountain Building, Frisch, Meschede and Blakey, 2011. Free download through UTSC library - Online Course Reserve (quercus link).

Additional downloads: Structural Analysis and Synthesis: A laboratory course in Structural Geology, Rowland, Duebendorfer, & Schiefelbein, Blackwell Publishing, 3rd Edition. (course reserve)

Marking Scheme

Assessment	%	Details	Due Date
10 Labs	30%	Attendance and participation during the laboratories are mandatory and the respective assignments are graded. The purpose of the weekly labs is to demonstrate practical methods for structural data analysis and interpretation of geologic maps/cross sections. During the lab you will have a chance to work independently in order to strengthen your knowledge; Lab assignments are to be completed in one week and submitted in the following week's lab. The knowledge acquired during the laboratory exercises can also be tested in the 3 Online Quizzes. **Needed for the labs:** Protractor (drawing circles, measuring angles), calculator with trig function A drafting ruler (inches and centimeters), small scissors, pencils, eraser, color pencils Metric (millimeter) graph paper (get at e.g. Walmart or Amazon) for precise drawings of geologic cross sections.	See schedule
3 Online Quizzes	6%	The knowledge acquired during the laboratory exercises can also be tested in the 3 Online Quizzes. The online quizzes will be posted (see course schedule) and each quiz is 2 % (6% total) of final grade. Each quiz will consist of roughly 10-20 questions (multiple choice, True/False).	See schedule
Lecture Participation	5%	Your active course participation is worth 5% of the final grade (grade is not based on correct answers, but participation). Participation in the lecture exercises will be tracked by the instructor or based on the electronic submission of your in-class exercises (e.g. in electronic file form or discussion board posts). You can miss up to 25% of the (live - recorded lecture) activities without losing grades, hence if your participation is between 100-75% off all lectures, you will get the full 5%. If your participation is between 75 and 50% you will get 2.5% of the participation mark. If your participation is below 50% no participation marks will be given (0%).	

Assessment	%	Details	Due Date
Midterm	26%	This test will be scheduled for the weekend after Reading Week. The midterm test may be held as a 2-3 day (open book, online) test through Quercus. To guarantee that rules about academic integrity and ethics are followed, the online plagiarism detection tool will be used. For more information see Plagiarism Tool Use paragraph under Policies/Statements below.	March 1 - 3
Final Exam	33%	The final exam will be held in form of a 3-day (open book, online) exam through Quercus. It may test all learned materials and skills that were discussed and practiced throughout the term. The final exam will be scheduled by the registrar's office. To guarantee that rules about academic integrity and ethics are followed, the online plagiarism detection tool will be used. For more information see Plagiarism Tool Use paragraph under Policies/Statements below.	Final Exam Period

Course Schedule

Week	Lecture Date	Lecture topic	Exercise	Lab Date	Lab Nr.	Lab	Other
1	Jan. 9	Lect. 1: Intro + Stress		Jan. 9	Lab 0	Lab techniques prep	
2	Jan. 16	Lect.2: Strain	3D-Strain (deformation, ellipsoids)	Jan. 16	Lab 1	Strain Analysis	
3	Jan. 23	Lect. 3: Strain & Stress	Mohr circles	Jan. 23	Lab 2	Intro to mapping and geologic data	
4	Jan. 30	Lect. 4: More maps, cross sections - Lab Techniques Prep. (Cont. Lab 0)	Box models, layer geometry, true-dip apparent dip	Jan. 30	Lab 3	Maps cross sections inclined beds	**Quiz 1, Topographic & Geologic Maps and Cross Sections**
5	Feb. 6	Lect. 5: Changes with depth, Brittle	Brittle Def.	Feb. 6	Lab 4	Faults (map -cross section)	
6	Feb. 13	Lect. 6: Brittle + Ductile	Folds	Feb. 13	Lab 5	Drill hole + Folding: 1st-2nd order structures	
Feb. 19 - 23		Reading Week					
7	Feb. 27	Lect. 7: Stereonet: Inclined Beds + Folds	Stereo Projections Schmidt Net: planes, fold	Feb. 27	Lab 6	Schmidt Net (folds), cross s. -maps	3-day Open Book Take Home Midterm Project
8	Mar. 5	NO LECTURE - PDAC Convention (Metro Center)		Mar. 5	NO LAB		
9	Mar. 12	Lect. 8: Ductile (foliation, shear zones)		Mar. 12	Lab 7	Schmidt net stress directions, geo map	**Quiz 2**
10	Mar. 19	Lect. 9: Ductile (foliation, shear zones etc) + Compressional Regime		Mar. 19	Lab 8	Shear Zones + SC fabrics (picture analysis)	
11	Mar. 26	Lect. 10: Compressional & Tensile	3D Google Earth: folds & faults (regional scale)	Mar. 26	Lab 9	Google Earth Mapping	
12	Apr. 2	Lect. 11: Tensile and Strike slip Regime, other		Apr. 2	Lab 10	Analogue Model + finish map	**Quiz 3**
13	Apr. 8	Last day of Term	**Study Break (April 9-11)**				

Policies & Statements

Late Assessment Submissions Policy

If you know that you will miss a deadline then please let the instructor and TA know in advance, as we might be able to work something out. Should you miss a deadline for any term work you will be automatically penalized **5%** *per day* **(including weekends)** if you do not follow the following procedure and receive consideration.

Within **one week** of the missed deadline you must submit a completed **UTSC Verification of Student Illness or Injury** (https://www.utsc.utoronto.ca/~registrar/resources/pdf_general/UTSCmedicalcertificate.pdf) as well as a **letter from you** describing when you fell ill, how it prevented you from making the deadline and when you returned to school. Submit the certificate and the letter to the instructor. Carefully following this process will allow us to properly consider you for consideration regarding your late/missed work for EESC37.

Plagiarism Detection Tool

Normally, students will be required to submit their course essays to the University's plagiarism detection tool for a review of textual similarity and detection of possible plagiarism. In doing so, students will allow their essays to be included as source documents in the tool's reference database, where they will be used solely for the purpose of detecting plagiarism. The terms that apply to the University's use of this tool are described on the Centre for Teaching Support & Innovation web site (https://uoft.me/pdt-faq).

Academic Integrity

The University treats cases of cheating and plagiarism very seriously. The University of Toronto's Code of Behaviour on Academic Matters (http://www.governingcouncil.utoronto.ca/policies/behaveac.htm) outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences.

Potential offences in papers and assignments include using someone else's ideas or words without appropriate acknowledgement, submitting your own work in more than one course without the permission of the instructor, making up sources or facts, obtaining or providing unauthorized assistance on any assignment.

On tests and exams, cheating includes using or possessing unauthorized aids, looking at someone else's answers during an exam or test, misrepresenting your identity, or falsifying or altering any documentation required by the University.

Equity, Diversity, and Inclusion

The University of Toronto is committed to equity, human rights, and respect for diversity. All members of the learning environment in this course should strive to create an atmosphere of mutual respect where all members of our community can express themselves, engage with each other, and respect one another's differences. U of T does not condone discrimination or harassment against any persons or communities.

The University of Toronto is a richly diverse community and as such is committed to providing an environment free of any form of harassment, misconduct, or discrimination. In this course, I seek to foster a civil, respectful, and open-minded climate in which we can all work together to develop a better understanding of key questions and debates through meaningful dialogue. As such, I expect all involved with this course to refrain from actions or behaviours that intimidate, humiliate, or demean persons or groups or that undermine their security or self-esteem based on traits related to race, religion, ancestry, place of origin, colour, ethnic origin, citizenship, creed, sex, sexual orientation, gender identity, gender expression, age, marital status, family status, disability, receipt of public assistance or record of offences.

Accommodations

Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability/health consideration that may require accommodations, please feel free to approach me and/or the AccessAbility Services Office as soon as possible.

AccessAbility Services staff (located in Rm AA142, Arts and Administration Building) are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations 416-287-7560 or email ability.utsc@utoronto.ca. The sooner you let us know your needs the quicker we can assist you in achieving your learning goals in this course.

Use of Generative Artificial Intelligence Tools

Students may use artificial intelligence tools, including generative AI, in this course as learning aids or to help produce assignments. However, students are ultimately accountable for the work they submit.

Students may not use artificial intelligence tools for taking tests, writing research papers, creating computer code, or completing major course assignments. However, these tools may be useful when gathering information from across sources and assimilating it for understanding.

The knowing use of generative artificial intelligence tools, including ChatGPT and other AI writing and coding assistants, for the completion of, or to support the completion of, an examination, term test, assignment, or any other form of academic assessment, may be considered an academic offense in this course.