	School of Science
	GEOL 208 Structural Geology
	Fall 2025 3 Credits

Course Outline

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CLASSROOMS: A2601 (lecture); A2206 (laboratory)
DATES: September 4, 2025, to December 20, 2025

COURSE DESCRIPTION

This course addresses the fundamental techniques in structural geology, including the mechanics of rock deformation, classification of tectonic structures in stratified and non-stratified rocks, and manipulation of structural data and its predictive use. The links between geological structures, mineral deposits, and exploration and mining practices are examined throughout the course, as is the interplay between deformation and plate tectonics. Students will spend considerable time learning how to understand structural data presented in geological maps and cross sections, as well as eventually developing those materials from their own data.

COURSE REQUIREMENTS

Prerequisite(s): Successful completion of GEOL 105 (Physical Geology) or permission from the instructor.

EQUIVALENCY OR TRANSFERABILITY

Receiving institutions determine course transferability. Find further information at: https://www.yukonu.ca/admissions/transfer-credit

LEARNING OUTCOMES

Upon successful completion of the course, students will be able to:

- Accurately describe all types of common structures exposed at the earth's surface.
- Measure a variety of geologic structures in the field (planes, lineations, fold axes, etc.).
- Analyze the geometry of structures using stereographic and orthographic projections.
- Interpret geological maps in 3D using cross sections and block diagrams.
- Make informed interpretations of structural evolution, based on structural geometry, kinematics and mechanical principles.
- Correlate small scale structures with the regional tectonic framework.

COURSE FORMAT

Weekly breakdown of instructional hours

This course consists of two 90-minute lectures and one three-hour lab period per week. The lecture schedule included in this course outline details the major topics covered and when those topics will be presented throughout the course. Please note that this schedule will likely be modified throughout the term, as some topics may not be finished within the predicted lecture time.

It is expected that this course will require 3-4 hours/week of homework and additional reading. It is important to note that the time required will vary by individual.

Delivery format

Lecture and lab sections for the Fall 2025 offering of this course will be delivered in-person on the Ayamdigut (Whitehorse) campus. Students are strongly encouraged to attend all lectures and laboratory exercises. Laboratory exercises will be conducted in both laboratory and field settings. Whereas students will be given after-hours access to the Earth Sciences laboratory (T1090) to complete lab assignments, the course instructor will not necessarily be present to guide learning. It is thus important that students fully engage and participate during the designated lab period. Off-campus field exercises must be completed during the allocated time with the instructor present.

EVALUATION

Weekly lab assignments (8)	32% (4% each)
Lecture midterm exam	15 %
Lecture final exam	25 %
Lecture theory assignments	8 % (4% each)
Takhini assemblage structural characterization project	20%
Total	100%

Assignments

Weekly lab exercises will be due at the start of the following lab section. In addition to these exercises, students will be assigned two short theory assignments for the lecture segment of the course. Details regarding these assignments are available on the course Moodle page.

This course has one project focused on the Takhini assemblage west of Whitehorse. Students will characterize fold styles and orientations, plus establish a deformation history, for an outcrop of greenschist-facies schists near Mendenhall subdivision. The project is due on the last day of classes *prior* to the final exam period.

Late assignments will be graded based on the following scheme: a deduction of 10% per day up until a total deduction of 50% is reached, following that, assignments must be submitted prior to the date that the instructor hands back the graded assignment (set by the instructor).

Examinations

This course has two lecture examinations, a midterm and a final. The midterm exam is conducted during scheduled lecture time; the final exam is conducted during the final exam period scheduled by the Office of the Registrar. The midterm lecture exam is a 1.5-hour exam; the final exam is designed to take 3 hours.

Missed exams will be assigned a grade of 0% unless re-scheduling for a valid reason is approved and determined in advance of the scheduled exam date. Any student who is absent from a test or exam for legitimate reasons will be eligible to write a deferred exam. Please note that excuses such as car trouble, vacation travel, oversleeping, and misreading the test schedule are not considered legitimate reasons and do not qualify the student for a deferred exam.

For missed exams, the student must contact the instructor within 48 hours of the missed exam by email. For missed final exams, students must contact the Chair of the School of Science. Any deferred exams will be scheduled by the Chair.

COURSE WITHDRAWAL INFORMATION

Refer to the YukonU website for important dates.

TEXTBOOKS & LEARNING MATERIALS

Waldron, J. and Snyder, M. 2020. Geological Structures: A Practical Introduction (1st ed.). Open Education Alberta. 225 p. https://pressbooks.openeducationalberta.ca/introductorystructuralgeology/

Additional resources (available on reserve in the Yukon University library)

Davis, G.H., Reynolds, S.J. and Kluth, C.F. 2012. Structural Geology of Rocks and Regions (3rd ed.). Wiley, Mississauga, ON. 864 p.

Fossen, H. 2010. Structural Geology (1st ed.). Cambridge University Press, New York. 463 p.

ACADEMIC INTEGRITY

Students are expected to contribute toward a positive and supportive environment and are required to conduct themselves in a responsible manner. Academic misconduct includes all forms of academic dishonesty such as cheating, plagiarism, fabrication, fraud, deceit, using the work of others without their permission, aiding other students in committing academic offences, misrepresenting academic assignments prepared by others as one's own, or any other forms of academic dishonesty including falsification of any information on any Yukon University document.

Please refer to Academic Regulations & Procedures for further details about academic standing and student rights and responsibilities.

ACCESSIBILITY AND ACADEMIC ACCOMMODATION

Yukon University is committed to providing a positive, supportive, and barrier-free academic environment for all its students. Students experiencing barriers to full participation due to a visible or hidden disability (including hearing, vision, mobility, learning disability, mental health, chronic or temporary medical condition), should contact Accessibility Services for resources or to arrange academic accommodations: access@yukonu.ca.

TOPIC OUTLINE

Session	Topic	Recommended Textbook Readings
1	Course introduction, primary versus deformational structures, types of structural analysis	Davis Ch. 1 (2-33)
2	Transformations, kinematics, displacement vectors, rigid vs. non-rigid body deformation, pure vs. simple shear	Waldron Section G; Davis Ch. 2 (35-58; 78-81)
3	Strain: strain ellipse, elongation, 1D and 2D strain, Flinn diagrams, introduction to quantification methods	Waldron Section G; Davis Ch. 2 (59-77), Ch. 9 (520-525); Fossen Ch. 3 (56-61)
4	Introduction to Stress**:** force, tractions; stress notation, normal vs. shear stresses and calculation; mean and deviatoric stress; principal stresses	Waldron Section I; Davis Ch. 3 (90-116)
5	Mohr stress diagrams, hydrostatic stress, cohesive strength, role of pore fluid pressure	Waldron Section I; Davis Ch. 3 (118-120); Fossen Ch. 4 (74-75), Ch. 7 (127-129)
6	Deformational behaviour (rheology): elastic, plastic, and viscous behaviour; common laboratory testing techniques, controls on deformational behaviour	Davis Ch. 3 (120-146)
7	Deformation mechanisms and microstructures I: point defects and dislocations, microfracturing and cataclasis, grain boundary rotation, frictional sliding	Davis Ch. 4 (148-162); Fossen Ch. 7 (120-121)
8	Deformation mechanisms and microstructures II: mechanical twinning, diffusion creep, pressure solution (dissolution creep), dislocation creep, recrystallization	Davis Ch. 4 (162 – 181) Fossen Ch. 10 (207-214)
9	Joints: joints vs. shear fractures, fracture modes, initiation and propagation, fracture criteria, deformation bands	Waldron Section J; Davis Ch. 5 (193 – 212; 236-239)
10	Faults: naming and classification, deformation textures and fault rocks, strain significance of major fault types	Waldron Section K; Davis Ch. 6 (249-286); Fossen (152-161)
11	Compressional regimes and thrust faulting: regional overthrusting and thrust terminology, critical taper/orogenic wedge models, thrust geometries, fault propagation folds	Waldron Section L; Davis Ch. 6 (305-320); Fossen Ch. 16 (312-328).
12	Extensional regimes and normal faulting: blind and growth fault propagation, dilationary structures, relay ramps, low-angle detachments, orogenic collapse and core complexes	Waldron Section L; Davis Ch. 6 (321-333); Fossen Ch. 17 (334 -350)
13	Strike-slip faulting models: releasing and restraining bends, Riedel shears, flower structures, transpression and transtension	Waldron Section L; Davis Ch.6 (334-343) Fossen Ch. 18 (356-368)

14	Folds: geometric description, parallel vs. similar folding, anticlines vs. synclines, parasitic folds and Pumpelly's rule, cylindrical vs. conical folds	Waldron Section E; Davis Ch. 7 (345-365, 375-383)
15	Folding models and secondary related structures: flexural slip vs. flexural flow, passive slip vs. passive flow, kink folding	Waldron Section E; Davis Ch. 7 (390-403)
16	Cleavage: types (continuous, spaced, crenulation), strain significance, origins (pressure solution; grain rotation), axial planar cleavages	Waldron Section H; Davis Ch. 9 (463-486); Fossen (244-254)
17	Foliation development: phyllitic texture, schisosity and gneissosity, mylonitization and mylonite classification	Waldron Section H; Davis Ch. 9 (492-500**)**
18	Lineations: types of lineations (mineral, intersection; crenulation, boudin, mullion), tectonites, kinematics from lineations	Davis Ch. 9 (501-512); Fossen Ch. 13 (260-279)
19	Shear zones I: general characteristics, geometries, types (brittle, ductile, brittle-ductile), softening mechanisms, coaxial and noncoaxial deformation	Waldron Section M; Davis Ch. 10 (531-555); Fossen Ch. 15 (286-297)
20	Shear zones II: shear sense indicators (e.g. offset markers, foliation patterns, shear bands, S-C fabrics, mica fish, pressure shadows, en echelon veining)	Waldron Section M; Davis Ch. 10 (555 – 576); Fossen Ch. 15 298-306)
21	Progressive deformation: instantaneous and finite strain ellipses, progressive pure and simple shear, scale dependence	Davis Ch. 10 (586-598); Fossen Ch.2 (44-48)
22	Data processing and interpretation from Hamilton Boulevard field trip	n/a
23	Data processing and interpretation from Takhini Assemblage field trip	n/a

LABORATORY ACTIVITIES

Session	Topic
1	Field Trip: Structural analysis of the Takhini Assemblage, field data collection (September 9)
2	Field Trip: Structural analysis of the Takhini Assemblage, field data collection (September 16)
3	Field Trip: Rock mass characterization at Hamilton Boulevard (September 23)
4	Methods of strain quantification
5	Mohr circles, failure envelopes, and pore pressure
6	Introduction to stereonet analysis (plotting planes, lineations, and poles)
7	Stereonets: apparent dips, rotations, and angular relationships
8	Stereonets: joint and fault analyses (contouring, rose diagrams, principal stresses)
9	Stereonets: fold analyses (β-diagrams, π-girdles, fold axes, interlimb angles, axial planar cleavages)
10	Cross sections and fold construction: angular kink fold and busk arc fold models
11	Cross-sections: projection of structural data into line of section, basics of cross-section balancing

The above topics are first-order themes for weekly lab exercises. Each laboratory handout will provide a detailed introduction to the theory and techniques needed to be successful in the exercise. No laboratory exercises will be conducted during the first week of classes.