Spring 2026

GEOL 401
Structural Geology

Wednesday/Friday, 12:00-1:15 pm; Exploratory 1005
Friday, 1:30-4:10 pm; Exploratory 1005

Instructor: Dr. Andrew Hoxey, ahoxey@gmu.edu
Office hours: Wednesday, 2:00-3:30 pm
Office: 3412 Exploratory Hall

Course Description

> *Structural geology is not about faults and folds, it's about kinematics…*
> - *An Yin*

This course will examine the stresses, kinematics, and resulting strain associated with geologic deformation. Reading and lecture material will cover fundamental concepts of structural geology from a qualitative and quantitative perspective. Labs will provide an opportunity for students to develop and practice skills related to quantitatively describing geologic features in three dimensions. Geometric descriptions will act as a foundation for problem solving and making interpretations about Earth's deformation history and regional tectonics.

Course Goals

Student Learning Outcomes of the class:

- Gain the vocabulary necessary to describe and understand structural geology.
- Develop skill using analytical methods to quantify strain recorded by structural features.
- Gain and intuitive understanding of three-dimensional features through quantitative assessments of measurable attributes.
- Participate in scientific inquiry by interpreting strain to understand regional kinematics.

Methods for achieving our goals:

- Lectures covering fundamental principles of structural geology
- Lab activities that introduce methods for describing and interpreting geologic deformation
- Lab activities that include interpretation and collection of data from maps, imagery, and other data types.
- Constructing cross sections based on published geologic maps
- Exams covering lecture material

Required Materials

Structural Geology of Rocks and Regions 3rd Edition; George H. Davis, Stephen J. Reynolds, Charles F. Kluth

Structural Analysis and Synthesis: A Laboratory Course in Structural Geology 4th Edition; Stephen M. Rowland, Ernest M. Duebendorfer, & Alexander Gates

- Must Order **Physical** Copy

Fine-tipped pencils and pens

Drafting Markers (optional, but highly encouraged)
Note: do not purchase drafting *pens*, they must be *markers* like Microperm
https://a.co/d/5xwMeHS

Ruler

Course Grades

Grading will be on a 1000-point scale, with points earned the following way:

Item	Points
Exams (3 total)	450
Lab Exercises (10)	350
Field Trip	100
X-Section Presentation	100
Total	1000

Exams

Attendance for exams in required. Exams will consist of a series of short answer questions and essay questions. Expect to reproduce figures and/or sketches to fully answer all the questions. The Final Exam will be cumulative.

Lab Exercises

Most labs will be sourced from the lab manual with some supplementary material. You are *highly encouraged* to read the lab instructions before coming to lab.

Field Trip

The field trip will be an opportunity to practice recognizing and interpreting structural features in the field. All faults look different. The more experience you have looking at structures in the field, the better you will be at identifying and interpreting deformation.

Cross Section Presentation
Each student will produce a cross section based on a published map from the map library. On the final day of class, all students will present their cross sections to the class. Maps will be assigned mid-way through the semester.

Late Work
Lab assignments will be due at the **Start** of the following week's lab. Lab assignments turned in after the start of lab will incur a 20% penalty, an additional 20% penalty will incur for each additional day past due.

If you leave the lab period early without an excused absence, you are required to turn in your lab before you leave. Otherwise, labs are due at the start of following week's lab.

Communication
Please communicate with me! Email is the most efficient way to communicate with me. Writing professional emails is a requirement in all workplaces and this course. Emails should include the course number in the subject line, a salutation, and a by-line.

I am happy to meet with you outside of class and/or normal office hours. If you are unavailable during office hours and need to make an appointment, please contact me with two proposed times you are available to meet.

Other class policies
You are encouraged to work in groups during the lab, however, you must hand in individual work.

You are not permitted to use AI in lab or for assignments unless otherwise stipulated by the assignment.

GMU POLICY GUIDELINES
These university and class policies are important to understand:

- Integrity: GMU has academic standards with guidelines regarding academic integrity; please see academicstandards.gmu.edu/ for more information.
- Disability: If you are a student with a disability and you need academic accommodations, please contact me and also contact the Office of Disability Services (ODS) at 703-993-2474 of ds.gmu.edu All academic accommodations must be arranged through the ODS.
- Diversity: Diversity is a core value at GMU; please see https://oacc.gmu.edu/ more information.
- Privacy: Students must use their MasonLive email account to receive important University information, including messages related to this class. Please see http://masonlive.gmu.edu for more information.
- Electronics: Please be respectful of our time together and do not engage in activities that are unrelated to class. Cell phones may be left on but muted and used for emergencies only.

Tentative Course Schedule

Date	Lecture Topic	Reading (Davis & Reynolds)	Lab	Chapter (LM) - Topic	Lab Problems; Supplement
21-Jan	Whole Earth Structure	Ch. 1 Nature of Structural Geology			
23-Jan	Faults		1)	1; 17 - Attitudes and Plate Tectonics	1.1, 1.2, 1.3, 1.4, 1.5, 17.1, 17.2; Plate diagrams
28-Jan	Folds	Ch. 7 Folds			
30-Jan	Folds Cont.		2)	2 - Map Patterns (rule of Vs)	2.1, 2.2, 2.3; Outcrop Projection; Basic X-sections
4-Feb	Faults and Map Patterns	Ch. 6 Faults			
6-Feb	Fault Zones		3)	3 - Stereonet 1: Apparent Dip	3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.9, 3.10, 3.12
11-Feb	Extension				
13-Feb	Contraction		4)	4 - Folds and X-Sections	4.1, 4.2, 4.4*, 4.5; Block Diagrams; Busk and Kink; Playdoh
18-Feb	Shearing				
20-Feb			5)	5; 7 - Stereonet 2: Folds	5.1, 5.3, 5.4, 7.1, 7.2, 7.3; X-Section 1
25-Feb	**Exam 1 - Map-scale Geometries**				
27-Feb	Stress and Strain	Ch. 3 Stress	6)	12 - Faults	12.1, 12.2, 12.4; X-Section 1
4-Mar	Stress Tensors				
6-Mar	Mohr Circle of Stress		7)	16 - Balanced X-Sections	16.1, 16.2, 16.3, 16.4, 16.5
11-Mar	**SPRING BREAK**				
13-Mar	**SPRING BREAK**				
18-Mar	Strain	Ch. 2 Displacement and Strain			
20-Mar	Rock Deformation	Ch. 4 Rock Mechanics	8)	6; 17 - Stereonet 3: Rotations and Moment Tensors	6.1, 6.2, 6.3, 6.5, 6.6, 17.3, 17.5
25-Mar	Brittle Deformation	Ch. 5 Joints			

27-Mar	Fracture Propagation		9)	10 - Brittle Failure	10.1, 10.2, 10.3, 10.9
1-Apr	Intrusions				
3-Apr	Andersonian Theory of Faulting		10)	8; 15 - Strain & Strain Fabrics	8.1, 8.2, 8.4, 15.1, 15.2, 15.4, 15.5, 15.9
8-Apr	**Exam 2 - Stress & Strain**				
10-Apr	**FIELD TRIP**		11)	**FIELD TRIP**	
15-Apr	Rheology				
17-Apr	Metamorphic Fabrics	Ch. 9 Foliations and Lineations	12)	X-Section	X-Section 2
22-Apr	Dislocations				
24-Apr			13)	X-Section; Compass Quiz	X-Section 2
29-Apr	Regional Tectonics				
1-May	Orogenic Systems		14)	X-Section Presentations 1:30-4:10	
5/11 @ 10:30-1:15	**FINAL EXAM**				

GMU Final Schedule - https://registrar.gmu.edu/calendars/spring_2026/

*Schedule may deviate to facilitate ideal learning