

Geology 341 - Structural Geology, Fall 2017

Lecture T-Th 10:00-11:15; LFG 105

Lab T-Th 2:30-5:15; LFG 103

PROFESSOR

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REQUIRED TEXTBOOK AND LAB MANUAL:

Lecture: Structural Geology, Haakon Fossen, 2nd Edition

Lab: Structural Analysis and Synthesis, Rowland, S., and Duebendorfer, E., Schiefelbien, I., 2006

SUPPLEMENTARY TEXTBOOKS AND LABORATORY MANUALS:

(on reserve in Library)

Structural Geology, Twiss, R.J., and Moores, E.M., 1992

Principles of Structural Geology, Suppe, J., 1985

Basic Methods of Structural Geology, Marshak, S., and Mitra, G., 1988

Purpose of Class

This course is an introduction to deformation of the lithosphere, from the atomic scale to the scale of mountain belts. We will consider the diverse mechanisms by which rocks deform, the resultant geologic features, and where specific deformation processes operate and geologic structures are developed, with respect to the fundamental types of lithospheric plate boundaries.

Learning Outcomes

Upon completion of this course, you will have acquired an introductory, but comprehensive understanding of the following topics:

- The various types of structural investigations: Geometric, kinematic, and dynamic
- The concepts of strain, progressive strain, and how we measure strain in rocks
- The concepts of stress and the different types of stress fields
- The interrelationship between stress and strain (rheology)
- The atomic-scale mechanisms by which rocks deform
- Geometric classification and kinematic analysis of faults
- Fault and fracture mechanics and the Mohr circle construction
- The structural styles of thrust, normal, and strike-slip faulting regimes
- The geometric classification of folds
- The kinematic and dynamics of folding
- Description and analysis of small scale structures including foliation and lineation
- Kinematic analysis of ductile shear zones
- Techniques for the measurement of strain in naturally deformed rocks

Logistics and Policies

1. Class Policy

The textbook and lab manual are required for the course. Reading assignments for the lecture are listed by date on the accompanying course outline. Please read the appropriate assignments before coming to the lecture. Material will be presented in lecture that is not covered in the textbook, so don't miss class! Please be aware that make-up lectures and make-up exams cannot be scheduled.

FIELD TRIPS: There will be two required field trips: an overnight 3-day field trip to the Death Valley region (October 13-15); and a one-day trip to the Clark Mountain thrust complex (November 19). The aim of the trips is to examine the structural record of Mesozoic contractional and Cenozoic extensional tectonics in the southwestern United States, and outcrop-scale study of mesoscopic structural features which we will then continue to analyze in laboratory.

2. Assessment (grading)

Your course grade in GEOL 341 is based on the following criteria:

Quizzes, 6 (will drop lowest)	15%
Lab Work	30%
2, 1 hour exams	35%
Final exam	20%

Material for the 1-hour lecture exams will focus on lecture and textbook information covered since the previous exam. The final exam is comprehensive, but will emphasize the last block of material covered since exam II. There will be 6 quizzes in class, given about every other week. The lowest quiz grade will be dropped.

The laboratory part of this class will be accessed as follows:

Lab assignments, all weighted equally	85%
Bree Creek Synthesis	15%

3. Academic Misconduct—Academic integrity is a legitimate concern for every member of the campus community; all share in upholding the fundamental values of honesty, trust, respect, fairness, responsibility and professionalism. By choosing to join the UNLV community, students accept the expectations of the Student Academic Misconduct Policy and are encouraged when faced with choices to always take the ethical path. Students enrolling in UNLV assume the obligation to conduct themselves in a manner compatible with UNLV's function as an educational institution. An example of academic misconduct is plagiarism. Plagiarism is using the words or ideas of another, from the Internet or any source, without proper citation of the sources. See the *Student Academic Misconduct Policy* (approved December 9, 2005) located at: <https://www.unlv.edu/studentconduct/student-conduct>.

4. Attendance Policy –

Lecture: Regular class attendance is not required, but is highly recommended. There will be 6 in-class Quizzes, and 2 in-class Exams, and neither can be made up if missed with the exception of religious holidays (see below). There will be content introduced and discussed in class that is not covered in the textbook.

Laboratory: In-class attendance of the laboratory part of this class is required.

5. Copyright—The University requires all members of the University Community to familiarize themselves with and to follow copyright and fair use requirements. You are individually and solely responsible for violations of copyright and fair use laws. The university will neither protect nor defend you nor assume any responsibility for employee or student violations of fair use laws. Violations of copyright laws could subject you to federal and state civil penalties and criminal liability, as well as disciplinary action under University policies. Additional information can be found at: <http://www.unlv.edu/provost/copyright>.

6. Disability Resource Center (DRC)—The UNLV Disability Resource Center (SSC-A 143, <http://drc.unlv.edu/>, 702-895-0866) provides resources for students with disabilities. If you feel that you have a disability, please make an appointment with a Disabilities Specialist at the DRC to discuss what options may be available to you. If you are registered with the UNLV Disability Resource Center, bring your Academic Accommodation Plan from the DRC to the instructor during office hours so that you may work together to develop strategies for implementing the accommodations to meet both your needs and the requirements of the course. Any information you provide is private and will be treated as such. To maintain the confidentiality of your request, please do not approach the instructor in front of others to discuss your accommodation needs.

7. Religious Holidays Policy—Any student missing class quizzes, examinations, or any other class or lab work because of observance of religious holidays shall be given an opportunity during that semester to make up missed work. The make-up will apply to the religious holiday absence only. It shall be the responsibility of the student to notify the instructor within the first 14 calendar days of the course for fall and spring courses (excepting modular courses), or within the first 7 calendar days of the course for summer and modular courses, of his or her intention to participate in religious holidays which do not fall on state holidays or periods of class recess. For additional information, please visit: <http://catalog.unlv.edu/content.php?catoid=6&navoid=531>.

8. Incomplete Grades—The grade of I—Incomplete—can be granted when a student has satisfactorily completed three-fourths of course work for that semester/session but for reason(s) beyond the student's control, and acceptable to the instructor, cannot complete the last part of the course, and the instructor believes that the student can finish the course without repeating it. The incomplete work must be made up before the end of the following regular semester for undergraduate courses. Graduate students receiving "I" grades in 500-, 600-, or 700-level courses have up to one calendar year to complete the work, at the discretion of the instructor. If course requirements are not completed within the time indicated, a grade of F will be recorded and the GPA will be adjusted accordingly. Students who are fulfilling an Incomplete do not register for the course but make individual arrangements with the instructor who assigned the I grade.

9. Tutoring and Coaching—The Academic Success Center (ASC) provides tutoring, academic success coaching and other academic assistance for all UNLV undergraduate students. For information regarding tutoring subjects, tutoring times, and other ASC programs and services,

visit <http://www.unlv.edu/asc> or call [702-895-3177](tel:702-895-3177). The ASC building is located across from the Student Services Complex (SSC). Academic success coaching is located on the second floor of the SSC (ASC Coaching Spot). Drop-in tutoring is located on the second floor of the Lied Library and College of Engineering TEB second floor.

10. UNLV Writing Center—One-on-one or small group assistance with writing is available free of charge to UNLV students at the Writing Center, located in CDC-3-301. Although walk-in consultations are sometimes available, students with appointments will receive priority assistance. Appointments may be made in person or by calling 702-895-3908. The student's Rebel ID Card, a copy of the assignment (if possible), and two copies of any writing to be reviewed are requested for the consultation. More information can be found at: <http://writingcenter.unlv.edu/>.

11. Rebelmail—By policy, faculty and staff should e-mail students' Rebelmail accounts only. Rebelmail is UNLV's official e-mail system for students. It is one of the primary ways students receive official university communication such as information about deadlines, major campus events, and announcements. All UNLV students receive a Rebelmail account after they have been admitted to the university. Students' e-mail prefixes are listed on class rosters. The suffix is always @unlv.nevada.edu.

12. Learning Environment

The classroom is intended to be a place of learning. As such and as specified in the UNLV Undergraduate Catalog, no pagers, cell phones, or other potentially disruptive devices are allowed in either lecture or the laboratory.

13. Final Examinations—The University requires that final exams given at the end of a course occur at the time and on the day specified in the final exam schedule. See the schedule at: <http://www.unlv.edu/registrar/calendars>.

14. Lab Overview – The lab manual will introduce you to various techniques of structural analysis. As you learn these techniques, you will apply them to a hypothetical map area, the Bree Creek Quadrangle. Your ultimate goal, and the final lab assignment, is a synthesis of the structural history of the area. It is important to keep up to date with lab work, otherwise you will have insufficient time at the end of the semester to do a good job on the Bree Creek synthesis.

15. Lab Policy – Lab assignments will be due at the beginning of the lab period, the week following the lab exercise. Please, no late labs! Labs will be returned, graded, during our next lab period. Please read the background material in each assigned chapter before coming to lab. Use the time in lab to work on assigned problems, not to read the chapter. You will probably not have time to complete written assignments in lab. Outside work is expected, so use lab time wisely.

Lecture Course Outline

Lec. #	Date	Topic	Reading Chpt., page
1	8/29	Introduction to Structural Geology	1, 1-23
2	8/31	Strain I	2, 25-55
3	9/5	Strain II	2, 25-55
4	9/7	Strain Measurement	3, 59-70
5*	9/12	Stress I	4, 73-80
6	9/14	Stress II	5, 83-98
7	9/19	Rheology	6, 101-120
8	9/21	Deformation Mechanisms I	11, 235-255
9	9/26	Deformation Mechanisms II	11, 235-255
10*	9/28	Fault and Fracture mechanics	7, 123-150
	10/3	Exam I	
11	10/5	Joints and Veins	8, 153-175
12	10/10	Faults	9&10, 177-188, 221-232
13*	10/12	Thrust Faulting I	17, 355-374
		Death Valley Field trip (10/13- 15)	
14	10/17	Thrust Faulting II	17, 355-374
15	10/19	Normal Faulting I	18, 377-396
	10/24	No Class – Seattle GSA	
16*	10/26	Normal Faulting II/MCCs	18, 377-396
17	10/31	Strike Slip Faulting I	19, 401-414
18	11/2	Strike Slip Faulting II	19, 401-414
	11/7	Exam II	
20	11/9	Folds I – Geometry and Classification	12, 257-280
21	11/14	Folds II - Kinematics and Dynamics	12, 257-280
22*	11/16	Planar Minor Structures	13, 283-299
		Clark Mountain Field Trip (11/19)	
23	11/21	Linear and Planar Minor Structures	13&14, 283-299, 301-312
		No Class 11/23, Thanksgiving Holiday	
24	11/28	Linear structures, Boudinage	14, 301-312, 15, 315-326
	11/30	Ductile Shear Zones	16, 329-352
25	12/5	Ductile Shear Zones	16, 329-352
26*	12/7	Ductile Shear Zones and Kinematics	16, 329-352
	12/12	10:10 AM - 12:10 PM: Final Exam	

* Quiz

Lab Schedule

<u>Lab Event</u>		<u>Lab Topic</u>	<u>Reading</u>
1	Aug 29-31	Attitudes of Lines and Planes Intro to Stereographic Projection I	RD 1 RD 5
2	Sept 5-7	Outcrop Patterns and Structure Contours Stereographic Projection II	RD 2 RD 5
3	Sept. 12-14	Geologic Maps I: Strike and Dip and Unit thickness determination*	RD 3
4	Sept. 19-21	Geologic Cross Sections*	RD 4
5	Sept. 26-28	Balanced Cross Sections	RD 15
6	Oct. 3-5	Fracture Mechanics & Mohr Stress Circles	RD 13
7	Oct. 10-12	<i>No Lab Oct 10-12. Death Valley Field Trip (Oct 13-15)</i>	
8	Oct. 17-19	Death Valley Field Trip Work Session	
9	Oct. 24-26	<i>No Class – Seattle GSA</i>	
10	Oct. 31-Nov 2	Faults	RD 9
11	Nov. 7-9	Folds and stereographic analysis	RD 6, 7
12	Nov. 14-16	Parasitic Folds, small scale structures Hand Samples	RD 8, 16 RD 16
		<i>Clark Mountain Field Trip (Nov 19)</i>	
13	Nov. 21-23	No lab, Thanksgiving Week	
14	Nov. 28-30	Clark Mountain work session	
15	Dec 5-7	Bree Creek Synthesis Due: No Lab	