GEOL 3411: STRUCTURAL GEOLOGY, SPRING 2020
MWF 10:00 – 10:50, Lab: T 2:00 – 4:50

GEOL 3411: A study of ways rocks and continents deform by faulting and folding, methods of picturing geologic structures in three dimensions, and causes of deformation. Includes a weekend field trip project. Prerequisite: Physical Geology or Historical Geology

Professor: Dr. Joe Satterfield
Office: VIN 122
Office phone: 325-486-6766
Physics and Geosciences Department Office: 325-942-2242
E-mail: joseph.satterfield@angelo.edu

Office hours
• Monday: 8:00 – 10:00 am, 1:00 – 3:00 pm
• Tuesday: 9:00 – 11:00 am
• Wednesday: 8:00 – 10:00 am, 2:00 – 3:00 pm
• Thursday: 10:00 – 11:00 am
• Or contact me to set up a convenient time to meet

Required Textbook

Grading
• 2 exams over lecture, text, and project topics: 12% each
• 1 comprehensive final exam, 16%
• 11 graded lab projects, including one required weekend field trip project: 55% (5% each)
• 1 summary and discussion of a scientific paper, 5%

Course Expectations
1) You are expected to attend every class meeting. Your attendance will be recorded.

2) Take the next big step: let’s talk in outside of lab about almost anything. My office, VIN 122, is a good place to find me or to see where I am. Topics I like to discuss: geology, hiking and backpacking trails, productive ways of learning geology, racquetball, Lord of the Rings, future careers, lame jokes, and more.

3) Do not distract yourself or others with electronic devices in lecture or lab. Put them away. Step outside the room if you must text or take a call.
Field Trip
1. **Lab 11: Mariscal Mountain, Big Bend National Park**: Friday – Sunday February 7 – 9, departing 12:00 noon. We will spend all Saturday exploring the cinnabar mining area in northern Mariscal Mountain which contains Rocky Mountain and Basin and Range folds and faults. Four-wheel-drive may be required to reach this locality, which we have not visited since 2011.

Required Lab and Field Equipment
1. Geology field book (I will place an order for all interested and pay shipping)
2. Pad of Tracing paper, 8.5 in x 11 in or 9 in x 12 in (Buy at Hobby Lobby or Michaels)
3. Graph paper pad, 5-squares-per-inch grid
4. Set of colored pencils (Buy good ones at Hobby Lobby or Michaels)
5. Small protractor (4 inch)
6. Ruler

Course Webpages
The [Angelo State Blackboard site](#) contains PowerPoint slides, web links to scenic areas mentioned in class, practice problems, answers to lab assignments, and your official grades.

**Student learning outcomes**
1. To learn and practice skills needed for summer field camp, GEOL 3600, a 5- or 6-week field geology course. Look at Sul Ross State University Field Camp, [Sul Ross Field Camp information](#) or Indiana University Field Camp, [Indiana University Field Camp information](#)
2. To recognize and measure linear and planar structural features in rocks, folds, and faults. You will learn how to use a Brunton compass to measure structures in the field.
3. To describe and visualize three-dimensional orientations of folds and faults by constructing cross-sections, stereonets, and orthographic projections.
4. To make interpretations about the forces that deform rocks (dynamic analysis) and the history of deformation (kinematic analysis).
5. To make interpretations about the details of plate tectonics, especially aspects related to the Marathon-Ouachita, Cordilleran, and Basin and Range orogens exposed in West Texas mountains.

Field Gear and Camping Gear Sources
1. Happy Trails, San Angelo, [Happy Trails website](#)
2. ASU, [Outdoor Adventures Equipment Rental Information](#)
3. ASC Scientific, [Geology Equipment Website](#)

**Your future career in Geology**

GEO, the student organization for all interested in geology, meets twice a month, Wednesdays at 6:00 pm. The first meeting is January 23. GEO is a Student Chapter of [American Association of Petroleum Geologists](#).

**Late Assignment Policy**
- Ten points will be deducted if you turn in assignment after due date
- Late assignments will not accepted after graded labs returned or key posted. These are ethics issues!

**Copyright Policy**
Students officially enrolled in this course should make only one printed copy of the given articles and/or chapters. You are expressly prohibited from distributing or reproducing any portion of course readings in printed or electronic form without written permission from the copyright holders or publishers.
<table>
<thead>
<tr>
<th>Week</th>
<th>Lecture/Discussion Topics</th>
<th>Lab Projects</th>
</tr>
</thead>
</table>
| I: 1/13, 1/15, 1/17 | 1) Nature of Structural Geology (Ch 1) 
2) Opportunities to order field book, hand lens 
3) Folding block, drawing strike and dip symbols, apparent dip | 1: Dagger Mountain cross-section, Converting true dip to apparent dip (p. 718 – 721) |
| II: 1/22, 1/24   | 1) Useful primary structures: graded beds, crossbeds, load casts 
2) Displacement and strain (Ch 2) 
3) Strain analysis projects (Belemnites, Skolithos, Brachiopods) | 2: Orthographic Projections (Ragan, Ch 1 and 2) |
| III: 1/27, 1/29, 1/31 | 1) Strain projects reviewed and answers revealed 
2) Shear strain (Ch 2) 
3) Dilation (Ch 2) Using stylolites to interpret stresses | 3: Interpreting strike and dip from map patterns; The three-point problem (Ragan, Ch 3) |
| IV: 2/3, 2/5, 2/7 | 1) Simple vs Pure Shear in the Basin and Range (Ch 2) 
2) Force, Stress, and Strength (Ch 3) 
3) Introduction to stereographic projection (p. 735 – 742) | 3: Concluded – Constructing and Interpreting Structure Contour Maps |
| V: 2/10, 2/12, 2/14 | 1) Mohr Circle practice problems distributed 
2) Interpreting Principal Stress Directions from faults (Ch 3) | 4: Basic stereonet techniques |
| VI: 2/17, 2/19, 2/21 | 1) Joints and Shear Fractures (Ch 5) 
2) Big Bend structure paper distributed 
3) Project: mapping joints with aerial photos | 5: More stereonet techniques |
| VII: 2/24, 2/26, 2/28 | 1) 2/26: EXAM 1 (Chapters 1, 2, 3, 5) 
2) Ways of identifying subtle faults (Ch 6) | 6: Geologic map 2, cross-section and stereonets |
| VIII: 3/2, 3/4, 3/6 | 1) Slip versus Separation (Ch 6) 
2) Project: Advanced wood blocks 
3) Thrust faults and thrust belts (Ch 6) | 6: Continued |
| 3/9 – 3/13 | SPRING BREAK | |
| IX: 3/16, 3/18, 3/20 | 1) Thrust faults and thrust belts concluded (Ch 6) | 7: Drawing dip isogons and plotting Ramsay fold classes |
| X: 3/23, 3/25, 3/27 | 1) Normal faults, detachment faults, extreme extension (Ch 6) 
2) Project: Interpreting Corsair Trend seismic section 
3) Strike-slip faults and flower structures (Ch 6) | PAPER SUMMARY DUE 
Discuss paper in lab |
| XI: 3/30, 4/1, 4/3 | 1) More about describing folds (Ch 7) 
2) Finding big folds from S- and Z-folds in Marathon uplift (Ch 7) 
3) Interpreting subsurface structure contour maps (Ch 6) 
4) Basic and strange fold terms (April Fools contest; Ch 7) | 8: Fracture measurement, San Angelo State Park |
| XII: 4/6, 4/8 | 1) Fold geometry: Stereonets and dip isogons (Ch 7) 
2) Kinematic analysis of folds: buckling, flexural slip, flexural flow, passive (Ch 7) 
3) Project: Folding an Ice Cream Sandwich | Complete work on Lab 8 |
2) 4/17: EXAM 2 (Chapters 6, 7, and 8) | 9: Geologic map 3: Polyphase folding |
| XIV: 4/22, 4/24, 4/26 | 1) Causes of Folding (Ch 7) 
2) Reactivated faults (Ch 8) | 9: Cross-section Due |
<table>
<thead>
<tr>
<th>Week</th>
<th>Lecture/Discussion Topics</th>
<th>Lab Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3) Fault-fold interactions (Ch 8)</td>
<td>9: Complete work on nets, sequence of events</td>
</tr>
<tr>
<td></td>
<td>4) Polyphase folding (Ch 9)</td>
<td></td>
</tr>
<tr>
<td>XV:</td>
<td>1) Review projects</td>
<td>10: Constructing normal profile views of folds, down-plunge method (due at end of lab)</td>
</tr>
<tr>
<td>4/29, 5/1, 5/3</td>
<td>2) Review field trip (on-campus!)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3) Subsurface mapping project</td>
<td></td>
</tr>
<tr>
<td>XVI:</td>
<td>5/8</td>
<td>NOTE: LAB 11 IS THE SOLITARIO FIELD TRIP PROJECT</td>
</tr>
<tr>
<td>5/8</td>
<td>5/8: FINAL EXAM, 10:30 – 12:30</td>
<td></td>
</tr>
</tbody>
</table>

**Academic Integrity**

Students are expected to maintain complete honesty and integrity in all work. Any student found guilty of any form of dishonesty in academic work is subject to disciplinary action and possible expulsion from ASU. The College of Science and Engineering adheres to the [Statement of Academic Integrity](#).

**Plagiarism**

Plagiarism is a serious topic covered in ASU’s Academic Integrity policy in the Student Handbook. Plagiarism is the action or practice of taking someone else’s work, idea, etc., and passing it off as one’s own. Plagiarism is literary theft.

In your discussions and/or your papers, it is unacceptable to copy word-for-word without quotation marks and the source of the quotation. It is expected that you will summarize or paraphrase ideas giving appropriate credit to the source both in the body of your paper and the reference list. Papers are subject to be evaluated for originality via Turnitin. Find resources to help you understand this policy at the [ASU Writing Center](#).

**Accommodations for Students with Disabilities**

ASU is committed to the principle that no qualified individual with a disability shall, on the basis of disability, be excluded from participation in or be denied the benefits of the services, programs or activities of the university, or be subjected to discrimination by the university, as provided by the Americans with Disabilities Act of 1990 (ADA), the Americans with Disabilities Act Amendments of 2008 (ADAAA), and subsequent legislation.

Student Disability Services is located in the Office of Student Affairs, and is the designated campus department charged with the responsibility of reviewing and authorizing requests for reasonable accommodations based on a disability. It is the student’s responsibility to initiate such a request by contacting an employee of the Office of Student Affairs, in the Houston Harte University Center, Room 112, or contacting the department via email at ADA@angelo.edu. For more information about the application process and requirements, visit the [Student Disability Services website](#). The employee charged with the responsibility of reviewing and authorizing accommodation requests is:

Dallas Swafford, Director of Student Disability Services
Office of Student Affairs, Houston Harte University Center, Room 112
325-942-2047
dallas.swafford@angelo.edu
Title IX

The University prohibits discrimination based on sex, which includes pregnancy, sexual orientation, gender identity, and other types of Sexual Misconduct. Sexual Misconduct is a broad term encompassing all forms of gender-based harassment or discrimination including: sexual assault, sex-based discrimination, sexual exploitation, sexual harassment, public indecency, interpersonal violence (domestic violence and/or dating violence), and stalking. As a faculty member, I am a Responsible Employee meaning that I am obligated by law and ASU policy to report any allegations I am notified of to the Office of Title IX Compliance.

Students are encouraged to report any incidents of sexual misconduct directly to ASU’s Office of Title IX Compliance and the Director of Title IX Compliance/Title IX Coordinator at:
Michelle Boone, J.D.
Director of Title IX Compliance/Title IX Coordinator
Mayer Administration Building, Room 210
325-942-2022, michelle.boone@angelo.edu

You may also file a report online 24/7 at Title IX Incident Form.

If you are wishing to speak to someone about an incident in confidence you may contact the University Health Clinic and Counseling Center at 325-942-2173 or the ASU Crisis Helpline at 325-486-6345.

For more information about Title IX in general you may visit ASU Title IX webpages.

Student Absence for Observance of Religious Holy Days

A student who intends to observe a religious holy day should make that intention known in writing to the instructor prior to the absence. See ASU Operating Policy 10.19 Student Absence for Observance of Religious Holy Day for more information.

Incomplete Grade Policy

It is policy that incomplete grades be reserved for student illness or personal misfortune. Please contact faculty if you have serious illness or a personal misfortune that would keep you from completing course work. Documentation may be required. See ASU Operating Policy 10.11 Grading Procedures for more information.

General Policies Related to This Course

All students are required to follow the policies and procedures presented in these documents:

- Angelo State University Student Handbook
- Angelo State University Catalog

1 https://blackboard.angelo.edu
2 http://www.sulross.edu/geology-field-camp
3 http://www.indiana.edu/~iugfs/
4 http://www.happytrailsshop.com/
5 http://www.angelo.edu/dept/university_recreation/Outdoor_Adventures/equipment_rental.php
6 http://www.ascscientific.com/
8 https://www.aapg.org/about/membership/types/student
9 https://www.angelo.edu/student-handbook/community-policies/academic-integrity.php
10 https://www.angelo.edu/dept/writing_center/academic_honesty.php
11 https://www.angelo.edu/services/disability-services/
12 www.angelo.edu/incident-form
13 www.angelo.edu/title-ix
14 https://www.angelo.edu/content/files/14206-op-1019-student-absence-for-observance-of