Structural Geology – GEOL 4421  
Department of Physical and Environmental Sciences  
Fall 2019

A. COURSE INFORMATION

Course number/section:   GEOL 4421.001  
Class meeting time:      TR 11:00 – 12:15 pm  
Class location:          CS 226  
Lab meeting time:        T 02:00 – 03:50 pm  
Lab location:            CS 226  
Course Website:          https://bb9.tamucc.edu

B. INSTRUCTOR INFORMATION

Instructor:              Dr. Mohamed Ahmed  
Office location:         NRC 3101  
Office hours:           TR 1:00–3:30 pm or by appointment  
Telephone:              (361) 825-3278  
e-mail:                 Mohamed.ahmed@tamucc.edu  
Appointments:           Please email instructor directly for an appointment, or if you have any  
                        questions or concerns.  
Lab instructor:          Elia Gil (egil@islander.tamucc.edu)

C. COURSE DESCRIPTION

Catalog Course Description  
Geometric and quantitative description of deformation of the Earth’s crust, mechanics of  
brittle and crystal-plastic deformation processes of Earth materials, introduction to  
continuum mechanics of geologic systems, crustal deformation from micro-scale to global  
tectonics. Laboratory introduces principles of three-dimensional data representation and  
analysis, geologic map interpretation, cross-section techniques, and problems in stress and  
strain analysis.

Extended Course Description  
Geology 4421 is an introduction to the study of structures found in the lithosphere, their  
description, nomenclature, and the geologic processes that form them. The course also  
introduces the student to numerical and graphical quantitative solution of structural problems.  
After a brief review of both non-tectonic and tectonic geological structures, the course will  
cover the basics of structural analysis (stress, strain and the relationship between the two). In  
the second half of the course, we will focus on the description and analysis of the chief  
classes of tectonic structures (faults, folds, shear zones, microstructures). The course will  
conclude with a look at plate tectonic processes from a structural perspective. Laboratory  
exercises will complement the material presented during the lectures.
D. PREREQUISITES AND COREQUISITES

Prerequisites
Prerequisites for this course are GEOL 3411 (Mineralogy), MATH 2413 (Calculus I), and PHYS 1401 (General Physics I) or PHYS 2425 (University Physics I).

Corequisites
SMTE-0094.W01 - Geology Lab Safety Seminar

E. REQUIRED TEXTBOOK(S), READINGS AND SUPPLIES

Required Textbook(s)
*Structural Geology, 2nd Edition* by Haakon Fossen, Cambridge University Press

Supplies
The lab exercises and lectures will require the use of some basic drafting supplies. The following is a list of what is needed. Please bring these items with you to each lab session. Some supplies may be available for student use while in CS 226.
- Stereonets (will be provided)
- Mechanical pencil, lead size of 0.5 mm or finer (required)
- Colored pencils (at least six colors, required)
- 12” ruler with mm markings (required)
- Protractor (required)
- Triangle (optional)
- Compass (required)
- Tracing paper (one tablet, can be shared, required)
- Graph paper (one tablet, can be shared, required)
- Calculator
- Eraser

F. STUDENT LEARNING OUTCOMES AND ASSESSMENT

Assessment is a process used by instructors to help improve learning. Assessment is essential for effective learning because it provides feedback to both students and instructors. A critical step in this process is making clear the course’s student learning outcomes that describe what students are expected to learn to be successful in the course. The student learning outcomes for this course are listed below. By collecting data and sharing it with students on how well they are accomplishing these learning outcomes students can more efficiently and effectively focus their learning efforts. This information can also help instructors identify challenging areas for students and adjust their teaching approach to facilitate learning.

By the end of this course, students should be able to:

1) Demonstrate familiarity with the principles of structural analysis,
2) Discuss the main types of geologic structures and their analysis,
3) Apply various laboratory techniques to solve structural problems, and
4) Apply the principles of structural geology within a broader context.

G. INSTRUCTIONAL METHODS AND ACTIVITIES

We will use a variety of instructional methods in this course, including lectures, discussions, and hands-on exercises.

H. MAJOR COURSE REQUIREMENTS AND GRADING

- COURSE GRADING

The student learning outcomes described in Section F will be measured through the assignments listed below.

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>FINAL GRADE (%)</th>
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<tbody>
<tr>
<td>Exam 1</td>
<td>15</td>
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<tr>
<td>Exam 2</td>
<td>15</td>
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<tr>
<td>Final exam</td>
<td>20</td>
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<tr>
<td>Quizzes</td>
<td>15</td>
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<tr>
<td>Lab Mid-term Exam</td>
<td>10</td>
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<tr>
<td>Lab Assignments</td>
<td>15</td>
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<tr>
<td>Presentation</td>
<td>10</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
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- GRADING POLICY

A: 90-100%
B: 80-89.9%
C: 70-79.9%
D: 60-69.9%
F: 0-59.9%

I. COURSE CONTENT/SCHEDULE

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Lab</th>
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<tbody>
<tr>
<td>1</td>
<td>Introduction – Syllabus, Class Policies</td>
<td>Lab1: Attitudes of Lines and Planes</td>
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<tr>
<td></td>
<td>Chapter 1: Structural Geology and Structural Analysis</td>
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<tr>
<td>2</td>
<td>Chapter 2: Deformation</td>
<td>Lab2: Outcrop Patterns and Structure Controls I</td>
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<tr>
<td>3</td>
<td>Chapter 3: Strain in Rocks</td>
<td>Lab3: Research Lab</td>
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<tr>
<td>Chapter</td>
<td>Title</td>
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| 4       | Chapter 4: Stress  
          Chapter 5: Stress in the Lithosphere |
| 5       | Chapter 5: Stress in the Lithosphere  
          Chapter 7: Fracture and Brittle Deformation |
| 6       | Chapter 7: Fracture and Brittle Deformation  
          Chapter 8: Joints and Veins |
| 7       | Chapter 9: Faults  
          **Exam 1** |
| 8       | Chapter 10: Kinematics & Paleostress in the Brittle Regime  
          Chapter 11: Deformation at the Microscale |
| 9       | Chapter 12: Folds and Folding |
| 10      | Chapter 13: Foliation and Cleavage  
          Chapter 14: Lineations |
| 11      | Chapter 15: Boudinage  
          Chapter 16: Shear Zones and Mylonites |
| 12      | Chapter 17: Contractional Regimes  
          **Exam 2** |
| 13      | Chapter 18: Extensional Regimes  
          **Presentations** |
| 14      | **Presentations**  
          Chapter 19: Strike-slip, Transpression, and Transtension |
| 15      | Chapter 22: A Glimpse of a Larger Picture  
          **Final Exam** |

Lab 4: Outcrop Patterns and Structure Controls II  
Lab 5: Interpretation of Geologic Maps  
Lab 6: Stereographic Projections I  
Lab 7: Stereographic Projections I  
Lab 8: Stereographic Projections II  
Lab 9: Folds; Stereographic Analysis of Folded Rocks  
Lab 10: Faults  
Lab 11: Dynamic and Kinematic Analysis of Faults  
Lab 12: Brittle Failure  
Lab Mid-Term Exam

Note: Changes in this course schedule may be necessary and will be announced to the class by the Instructor. The assignments and exams shown are directly related to the Student Learning Outcomes described in Section F.

**J. COURSE POLICIES**
Attendance/Tardiness
You are expected to attend all labs and remain in CS 226 during your entire lab period. Please make every effort to arrive to lecture and lab session on time, since important announcements are typically made at the beginning of lecture and lab.

Quizzes
Quizzes happen randomly and are used to encourage regular attendance in class and will consist of a short series of multiple-choice questions to be answered in approximately 10-15 minutes. The quizzes may include material covered in previous lectures or in the reading assignment for that day.

Late Work and Make-up Exams
There are no make-up labs. Most laboratory instruction cannot be conveniently repeated outside of the scheduled laboratory time. Therefore, attendance of your assigned lab session is required.

Exams can only be taken during the scheduled time, except in cases of emergencies. Documented proof is required of such emergencies. There will be NO make-up exams or quizzes for any unexcused absence. If you know you are going to miss a class or an exam and have a valid excuse, let me know BEFORE the fact, NOT after. Make-up exams cannot be taken after the graded test has been given back to the class. There will be no exceptions.

Extra Credit
None.

Cell Phone Use
The instructor discourages the use of electronic communication devices such as cell phones (texting, etc.) during class because they distract other students from the learning experience. Please place such devices in silent mode during class. If you must answer an emergency call, please walk unobtrusively out of the class, finish the conversation, and return to your seat equally unobtrusively.

Laptop/Tablet Use
You are welcome to bring a laptop or other devices to class with the presumption that you are using it to facilitate your own learning (take notes). The use of laptops for other uses is discouraged as it distracts from the learning experience. If the laptop/tablet becomes a distraction to you or others, I will ask you to discontinue the use of your laptop or tablet.

Food in Class
Drinks (with a lid) and snacks are allowed in lecture room, but no food or drink is allowed in CS 226. Drinks may be kept outside the lab room at your discretion.
K. COLLEGE AND UNIVERSITY POLICIES

- **Academic Integrity (University)**
  University students are expected to conduct themselves in accordance with the highest standards of academic honesty. Academic misconduct for which a student is subject to penalty includes all forms of cheating, such as illicit possession of examinations or examination materials, falsification, forgery, complicity or plagiarism. (Plagiarism is the presentation of the work of another as one’s own work.) In this class, academic misconduct or complicity in an act of academic misconduct on an assignment or test will result in a failing grade.

- **Classroom/Professional Behavior**
  Texas A&M University-Corpus Christi, as an academic community, requires that each individual respect the needs of others to study and learn in a peaceful atmosphere. Under Article III of the Student Code of Conduct, classroom behavior that interferes with either (a) the instructor’s ability to conduct the class or (b) the ability of other students to profit from the instructional program may be considered a breach of the peace and is subject to disciplinary sanction outlined in article VII of the Student Code of Conduct. Students engaging in unacceptable behavior may be instructed to leave the classroom. This prohibition applies to all instructional forums, including classrooms, electronic classrooms, labs, discussion groups, field trips, etc.

- **Statement of Civility**
  Texas A&M University-Corpus Christi has a diverse student population that represents the population of the state. Our goal is to provide you with a high quality educational experience that is free from repression. You are responsible for following the rules of the University, city, state and federal government. We expect that you will behave in a manner that is dignified, respectful and courteous to all people, regardless of sex, ethnic/racial origin, religious background, sexual orientation or disability. Behaviors that infringe on the rights of another individual will not be tolerated.

- **Deadline for Dropping a Course with a Grade of W (University)**
  I hope that you never find it necessary to drop this or any other class. However, events can sometimes occur that make dropping a course necessary or wise. Please consult with your academic advisor, the Financial Aid Office, and me, before you decide to drop this course. Should dropping the course be the best course of action, you must initiate the process to drop the course by going to the Student Services Center and filling out a course drop form. Just stopping attendance and participation WILL NOT automatically result in your being dropped from the class. Please consult the Academic Calendar (http://www.tamucc.edu/academics/calendar/) for the last day to drop a course.

- **Grade Appeals (College of Science and Engineering)**
  As stated in University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures, a student who believes that he or she has not been held to appropriate academic standards
as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is upon the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules website at http://www.tamucc.edu/provost/university_rules/index.html, and the College of Science and Engineering Grade Appeals webpage at http://sci.tamucc.edu/students/GradeAppeal.html. For assistance and/or guidance in the grade appeal process, students may contact the chair or director of the appropriate department or school, the Office of the College of Science and Engineering Dean, or the Office of the Provost.

- **Disability Services**
  The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please call (361) 825-5816 or visit Disability Services in Corpus Christi Hall 116.

  If you are a returning veteran and are experiencing cognitive and/or physical access issues in the classroom or on campus, please contact the Disability Services office for assistance at (361) 825-5816.

  http://disabilityservices.tamucc.edu/

- **Statement of Academic Continuity**
  In the event of an unforeseen adverse event, such as a major hurricane and classes could not be held on the campus of Texas A&M University–Corpus Christi; this course would continue through the use of Blackboard and/or email. In addition, the syllabus and class activities may be modified to allow continuation of the course. Ideally, University facilities (i.e., emails, web sites, and Blackboard) will be operational within two days of the closing of the physical campus. However, students need to make certain that the course instructor has a primary and a secondary means of contacting each student.

L. **OTHER INFORMATION**

- **Academic Advising**
  The College of Science & Engineering requires that students meet with an Academic Advisor as soon as they are ready to declare a major. The Academic Advisor will set up a degree plan, which must be signed by the student, a faculty mentor, and the
department chair. Meetings are by appointment only; advisors do not take walk-ins. Please call or stop by the Advising Center to check availability and schedule an appointment. The College’s Academic Advising Center is located in Center for Instruction 350 or can be reached at (361) 825-3928.

GENERAL DISCLAIMER

I reserve the right to modify the information, schedule, assignments, deadlines, and course policies in this syllabus if and when necessary. I will announce such changes in a timely manner during regularly scheduled lecture periods.