TEXAS A&M UNIVERSITY - CORPUS CHRISTI
COLLEGE OF SCIENCE AND TECHNOLOGY

GEOLOGY 4421 – STRUCTURAL GEOLOGY

Fall 2007

Dr. James R. Garrison – Office: NRC, Room 3101
Phone: 825-2254 or 877-7597
Email: james.garrison@tamucc.edu
Webpage: http://artesian.tamucc.edu/jgarrison/main.html

Class Time and Place: Tuesday and Thursday, 11:00 a.m. – 12:15 p.m., BH 128.
Lab Time and Place: Thursday, 2:00 – 4:00 p.m., CS 226.

Office hours

By appointment, or any time I am in and the door is open.
Location: NRC 3101

Course Description

Geology 4421 is an introduction to the study of structures found in the lithosphere, their quantitative description, nomenclature, and the geologic processes which form them. In the first half, this course covers the analysis of brittle structures (faults, fractures). The second half is devoted to structures exhibiting ductile flow (folds, ductile shear zones). The occurrence of these structures will be discussed within the framework of continuum mechanics (stress, strain, rheology of Earth materials). The course will conclude with a look at plate tectonic processes from a structural perspective. Laboratory exercises will introduce numerical and graphical techniques used to solve structural problems.

Audience

Advanced undergraduate students in Geology and Environmental Sciences

Student Learning Outcomes

This course is designed to

- gain a solid understanding of basic structural concepts and their analysis
- develop visualization skills to translate two-dimensional observations into three-dimensional models
- develop skills to interpret structural processes based on field and laboratory observations and physical intuition
- relate structural processes to underlying physical and chemical principles
- gain a working knowledge of structural terminology to read the technical literature and advanced textbooks

Course Requirements

Prerequisites: GEOL1403, MATH1316, and PHYS1401 or 2425.

Required Texts

Twiss, R. J., and Moores, E. M., 1992, Structural Geology, Freeman, ISBN 0-7167-2252-6
Marshak, S., and Mitra, G., 1988, Basic Methods of Structural Geology, Prentice Hall, ISBN 0-13-065178-8
Additional reading materials will be placed on library reserve

Instructional Methods and Activities

This is a senior-level undergraduate course. This implies that students are expected to demonstrate a large degree of independence in mastering the subject of this course. Attending the lecture will be one component to achieve this goal. Equally important components include reading the relevant textbook chapters prior and after they have been discussed in class, note taking during lecture, study of on-reserve

items in the library, and working the home work problems. Students should therefore be prepared to devote considerable outside-of-class time to course work. A traditional rule of thumb is three hours outside of class spent in reading and preparation for each class hour.
Students are expected to take their own lecture notes.

Attendance policy
Attendance on a regular basis will be essential to the successful completion of the course. There is no provision for making up late and/or missed work. It is your responsibility to obtain notes and announcements from fellow students in the event you miss a class.

Evaluation and Grade Assignment
Grade break-down is as follows:
Midterm 30%
Quizzes and class participation 10%
Lab assignments and exams 30%
Final 30%
No extra credit. Lab and lecture exams are separate.
I encourage you to work together for the purpose of mastering the general techniques taught in lab. However, what you turn in to be graded should be your own. Always, show how you obtained your results.

Lab assignments
Labs are due on the date specified on the lab assignment, usually at the beginning of next week's lab.
Labs late by up to one week are -30%. More than one week late: no credit.

University policies
By enrolling in this course you agree to follow university policies as stated in the Course Catalog and in the Student Handbook, including policies concerning student conduct, integrity and honesty, and special needs. The use of cell phones is not allowed in class.

Drafting Supplies
The lab exercises (and partially the lectures) will require the use of some basic drafting supplies. Please bring these items with you to each lab session. A small tackle box has been proven useful to keep your supplies at hand.

Stereonets: make a copy of p. 411 from Marshak and Mitra and paste on a piece of cardboard. Push a thumbtack through the center of the net. You will need this for the first lab meeting!
Mechanical pencil, lead size of 0.5 mm or finer
Colored pencils (at least 10 colors)
Black ink pen/felt pen with very fine tip (e.g. Sharpie ultra fine point)
Ruler with cm/mm markings
Triangle 30°-60°-90°
Protractor or protractor-ruler
Drawing compass (cheap o.k.)
Drafting velum (one tablet, velum is stronger and more transparent than tracing paper; tracing paper is not recommended)
Graph paper (metric with cm/mm ruling, one tablet)
Eraser. Get a good one!
Calculator

Schedule of Topics (subject to change)

TM: Twiss and Moores, MM: Marshak and Mitra

Lecture

Week 1,	Course overview and equipment
Week 2,	Introduction (TM chapters 1-2)
Week 3,	Fractures and faults (TM chapters 3-7)
Week 4,	cont'd
Week 5,	cont'd
Week 6,	Stress (TM chapter 8)
Week 7,	Mechanics of brittle deformation (TM chapters (9-10)
Week 8,	cont'd;
Week 9,	Ductile deformation (TM chapters 11-14)
	Mid-term
Week 10,	cont'd
Week 11,	Strain (TM chapters 15-17)
Week 12,	cont'd
Week 13,	Rheology (TM 18-20)
Week 14,	cont'd
	Thanksgiving (no class)
Week 15,	Tectonics (TM 21-22)

Final examination

Lab

Week 1,	no lab
Week 2,	Intro to Stereonets, MM p. 87-97, 101-102 (Plotting of planes and lineations, angles between planes and between lineations)
Week 3,	Geometric methods, MM p. 45-56, 81-83, 226-32 (True and apparent dip and bed thickness, nomogram, fault plane diagram)
Week 4,	Stereonet Techniques, MM p. 87-120 (True and apparent dip, rotations about vertical, horizontal, and inclined axes)
Week 5,	Structure Contours I, MM p. 27-34 (Review rule of V's, three point problems and structure contours of planar beds)
Week 6,	Tensor and Mohr diagrams, MM p. 193-212 (Deformation tensor in 2D, Mohr diagram for stress)
Week 7,	Structure Contours II, MM p. 19-27, 394, 396 (Structure contours of folded units, isopachs and isochores, volume calculation)
Week 8,	More on Mohr, MM p. 259-261 (Applied problems)
Week 9,	Take-home assignment (no lab)
Week 10,	Folds I, p. 213-226 (Folds intersecting with ground surface, π- and □-pole, fold shapes inferred from stereoplots)
Week 11,	Statistics of Directional Data (Kamb contours, rose diagram, vector mean)
Week 12,	Geologic Cross-Section
Week 13,	Strain Analysis, MM p. 333-359 (Ductile shear zone, Wellmann's method, Fry method)
Week 14,	Thanksgiving (no class)
Week 15,	12/1: Mesoscopic and microscopic structures, MM p. 226-247 (kinematic indicators, fabric analysis)