Fall 2018 Geology 4610 John

*Structural Geology and Tectonics*

*(4 credits)*

The purpose of this course is to improve your understanding of deformation of the Earth's lithosphere. This class will focus on the three-dimensional nature of structural features, how they relate to tectonic associations and processes, and their basic mechanical development. We will start the course taking three one-day field trips to see geologic structures in the field first hand. During these trips you are expected to observe and take careful notes. By the end of the course we anticipate you will be able to think in three-dimensions, feel comfortable collecting and working with structural data, and will start to appreciate how basic physical processes influence the primary structure of the Earth's lithosphere.

Pre-requisites:

It is assumed that you have a basic understanding of physical and historical geology (GEOL 1100), including mineralogy (GEOL 2010), rock classification, geologic time, and sedimentation/stratigraphy (GEOL 2100). A working knowledge of trigonometry and algebra are essential. Some knowledge of basic mechanics, as developed in the first semester, general physics and chemistry courses is also important.

Text:

The required texts are:

Davis, G. H., Reynolds, S.J., and Kluth, C., 2012

**‘Structural Geology of Rocks and Regions’ 3rd edition**

(ISBN: 978-0-471-15231-6)

Marshak, S., and Mitra, G., 1988

**‘Basic Methods of Structural Geology’**

(ISBN: 0-13-065178-8)

Supplementary text:

1) Richard W. Allmendinger, 2015-2017

‘**Modern Structural Practice: A structural geology laboratory manual for the 21st Century’**

download at -

<http://www.geo.cornell.edu/geology/faculty/RWA/structure-lab-manual/structure-lab-manual-full.pdf>

**Note -** There are many structural geology texts available including those authored by Twiss and Moores; Hobbs, Means and Williams; Fossen; van der Pluijm and Marshak, and Yeats to name a few. If you are having trouble with a particular topic, check out another from the library, and read through the relevant section(s). They are there for you to use, so enjoy.

Lectures: (MWF 10-10:50 am), Room GEOL 216

Lecture material represents the core of the course. It is therefore important to attend all lectures. I will show slides of geologic structures, maps, cross-sections, etc. to supplement the lecture and text. Questions from the class are welcome at any time. There will be a few homework assignments associated with the lecture material.

Labs: (T, W, or Th 2:10-4:00 pm) in Room GE 213 (T, W) or ESB 1038 (Th)

The lab is the 'hands-on' part of the course. We will begin lab with 3 field trips to local areas on **Sept. 15, 22 and 29, 2018.** You will be responsible to attend each of the field trips, observe structures in the field, keep a neat notebook, and submit your field materials in lab for comments and help. If the weather is poor any Friday, we may cancel and have the final field trip Saturday, October 6.

Some lecture time will be devoted to discussion of the lab work, so that maximum time in the lab is spent working on exercises. **Assignments outside those done in the field are due at the start of lab.** Some lab exercises will require graphical or analytical solutions of simple geometric problems. Other labs will emphasize the study and interpretation of geologic maps, cross-sections, or hand samples of rocks, as these provide the best alternative to visiting structures in the field. Structures and problems studied in the lab will parallel closely material covered in lecture. Note that materials in the lab, must stay there. **Please** do not take any materials from the lab.

Each student should bring the following to lab, starred items on the field trips:

lab manual (Marshak and Mitra) laminated stereonet (in class)

\*pencils (hard lead) \*colored pencils

\*eraser \*ruler

graph paper \*protractor

\*field notebook \*compass

tracing paper (tablet) calculator

A very-fine felt pen will be necessary for inking cross-sections and maps.

Office Hours:

**Professor**

John: ESB Room 3016

Tu/Th 9:30-11

or by appointment (bjohn@uwyo.edu; ph. 307-223-1951)

# TA(s) - Office hours TBD

Field Trips:

Field trips are scheduled for weekend days at the start of the semester (subject to weather). We will leave the parking lot adjacent to nursing (across the street from *Turtle Rock*) **at 8:00 AM, and return by 6 PM, Sept. 15, 22 and 29**, 2018. The purpose of each exercise is to allow you to see (and map) basic structural features in the field, describe and map them, collect your own structural data, plot them and make your own interpretation. Each field trip will build on the previous one, and will last most of the day. You will be required to attend the trip, carry out the basic exercise (rock description, structural measurements, and basic mapping), and submit your field notebook at the end of each day, for comments and evaluation.

Examinations:

There are three exams during the semester. Each will last one hour, and will be worth 100 points (300 points total for exams). Lab exercises, including field trip assignments will be handed in and graded (200 points total). Total number of possible points for the course is 500.

1st exam: Wednesday, October 3

2nd exam: Wednesday, November 7

3rd exam: Friday, Dec 14 (10:15-12:15)

**Note:** Lab is an integral part of the course. You must pass the lab (C or better grade- i.e. better than a C-) to pass the course. Exams given during the semester will include problems similar to those worked for the lab up to that time.

Academic Dishonesty:

*Academic dishonesty will not be tolerated. Cases of academic dishonesty will be treated in accordance with UW Regulation 2-114.*

*“Penalties for academic dishonesty can include, at my discretion, an “F” on an exam, an “F” on the class component exercise, and/or an “F” in the entire course. Academic dishonesty means anything that represents someone else’s ideas as your own without attribution. It is intellectual theft – stealing - and includes (but is not limited to) unapproved assistance on examinations, plagiarism (use of any amount of another person’s writings, blog posts, publications, and other materials without attributing that material to that person with citations), or fabrication of referenced information. Facilitation of another person’s academic dishonesty is also considered academic dishonesty and will be treated identically.”*

Students are expected to adhere to the above. If you have any questions about what is allowable and what is not, please ask ! These issues are sometimes not clear-cut, especially because you are doing group projects.

Classroom Behavior Policy:

*At all times, treat your presence in the classroom and your enrollment in this course as a job. Act professionally, arrive on time, pay attention, complete your work in a timely and professional manner, and treat all deadlines seriously. You will be respectful towards you classmates and instructor. Spirited debate and disagreement are expected in any classroom and all views will be heard fully, but at all times we will behave civilly and with respect towards one another. Personal attacks, offensive language, name-calling, and dismissive gestures are not warranted in a learning atmosphere. As the instructor, I have the right to dismiss you from the classroom, study sessions, labs and/or field trips, where disruptive behavior occurs.*

Cell phones in class:

Use of cell phones in class or in the field will not be tolerated. **Just turn them off.**

\*\**Note - Numerous studies have compared students who text during lecture versus those who did not.  Those who texted frequently took lower quality notes, retained.*

Communication:

I will send out a number of informational emails during the semester (regarding GEOL 4610 and upcoming field camp); be sure to check your UW email regularly.

*less information, and did worse on tests about the material*.

Classroom Statement on Diversity:

*The University of Wyoming values an educational environment that is diverse, equitable, and inclusive. The diversity that students and faculty bring to class, including age, country of origin, culture, disability, economic class, ethnicity, gender identity, immigration status, linguistic, political affiliation, race, religion, sexual orientation, veteran status, worldview, and other social and cultural diversity is valued, respected, and considered a resource for learning.*

Disability Support:

*The University of Wyoming is committed to providing equitable access to learning opportunities for all students.* *If you have a disability, including but not limited to physical, learning, sensory or psychological disabilities, and would like to request accommodations in this course due to your disability, please register with Disability Support Services (DSS), Room 128 Knight Hall as soon as possible.*

*You may also contact DSS at (307) 766-3073 or*[*udss@uwyo.edu.*](mailto:udss@uwyo.edu)*It is in the student’s best interest to request accommodations within the first week of classes, understanding that accommodations are not retroactive. Visit the DSS website for more information at:*[*www.uwyo.edu/udss*](http://www.uwyo.edu/udss)

Duty to Report:

*UW faculty is committed to supporting students and upholding the University’s non-discrimination policy. Under Title IX, discrimination based upon sex and gender is prohibited. If you experience an incident of sex- or gender-based discrimination, we encourage you to report it. While you may talk to a faculty member, understand that as a "Responsible Employee" of the University, the faculty member MUST report information you share about the incident to the university’s Title IX Coordinator (you may choose whether you or anyone involved is identified by name). If you would like to speak with someone who may be able to afford you privacy or confidentiality, there are people who can meet with you. Faculty can help direct you or you may find info about UW policy and resources at* [*http://www.uwyo.edu/reportit*](http://www.uwyo.edu/reportit)

*You do not have to go through the experience alone. Assistance and resources are available, and you are not required to make a formal complaint or participate in an investigation to access them.*

Miscellaneous:

# *Autobiography*

Due start of class Sept 5, 2018 - please turn in a one-page (hard copy) autobiography with the following information.

* Name (preferred nickname if applicable)
* Photo
* Hometown
* Phone, email
* Anticipated graduation date
* Degree sought (BA, BS, MS, etc)
* Geology and allied sciences (e.g., physical, strat/sed, mineralogy, geochem cycles, intro to geophysics, petrology, chem, calculus, physics, etc) that you have taken or are taking
* Interests (e.g., music, dance, backpacking, food, cat videos, etc.)
* Anything else you might like us to know

# *How to Get an A in this class*

* Attend class (!)
* Take notes (!)
* Ask questions --don’t hesitate to ask something; it is likely your classmates are wondering the same thing.
* Don’t be intimidated by the professor or TAs. We welcome your questions. **Please talk to me if you feel that there are any problems in this area.**
* Participate fully in projects…don't simply let your classmates do everything, as you aren’t learning
* Do reading assignments promptly
* Keep up with lab assignments and turn in promptly
* Share class notes with others and review theirs
* Come for help if you're having problems
* Study/practice answering old exam questions (I will hand out examples before each exam)

course outline and reading

Geology 4610

**I. Introduction to structure and tectonics: formation and structure of the** **Earth**

(DRK[[1]](#footnote-1), p. 2-29)

**II. Introduction to geologic maps, cross-sections, and basic structural field methods**

(DRK, p. 687-696; 711-726; 779-782; M/M Chapters 1 and 9); supplemental reading Allmendinger p. 1-8, 10-16

**III. Primary and non-tectonic structures (sedimentary and igneous)**

(DRK, p. 21; 697-711)

**IV. Stereographic projections**

(DRK, p. 735-747; 751-759; M/M p. 105-110)

supplemental reading Allmendinger p. 17-21

**V. Force and Stress**

(DRK, p. 90-120)

supplemental reading Allmendinger p. 32-35, 87-95, 99-104

**VI. Deformation and strain**

(DRK, p. 34-77; 120-147)

supplemental reading Allmendinger p. 131-134, 136-148, 155-161. 173-178

**VII. Brittle behavior**

(DRK, p. 226-248)

supplemental reading Allmendinger p. 113-119

**VIII. Origin of joints and veins**

(DRK, p. 193-225; M/M Chapter 11)

**IX. Faults and faulting; nomenclature and description**

(DRK, p. 249-259; 267-268; 272-280; 286-293)

supplemental reading Allmendinger p. 108-110; 179-192

**X. Fault rocks, fault zone models and kinematic analysis**

(DRK, p. 260-266)

supplemental video https://www.youtube.com/watch?v=m8TdvBs7WKE

**XI. Tectonic settings of fault systems:**

* thrust and reverse faults (DRK, p. 283-285; 305-320)
* normal faults (DRK, p. 281-283; 285; 321-333; active examples p. 656-681)
* strike-slip faults (DRK, p. 334-343; active examples p. 606-632)

**XII. Theories and paradoxes of faulting**

(DRK, p. 301-303)

**XIII. Folds and mechanisms of folding**

(DRK, p. 344-368; 375-404; M/M, p. 213-226)

supplemental reading Allmendinger p. 57-63

**XIV. Deformation mechanisms, microstructures, and penetrative rock fabrics**

(DRK, p. 148-190; M/M Chapter 11 - p. 223-246)

supplemental reading Allmendinger p. 160-162

1. DRK – Davis, Reynolds, and Kluth – ‘Structural Geology of Rocks and Regions’ [↑](#footnote-ref-1)