University of Alberta

EAS 233 Winter 2014

Geologic Structures

Course Objectives

EAS 233 Geologic Structures is about the structures in the Earth's crust that record the action of the Earth's tectonic systems over geologic time. In this course you will learn:

- to make accurate descriptions of all types of structures exposed at the Earth's surface;
- to use this information to understand three-dimensional structures within the Earth's crust;
- to make basic interpretations of the changes that produced these structures over geologic time.

Course Description:

Orientation, measurement description, and analysis of planar and linear structures in rocks, including folds, faults, and fabrics. Introduction to mapping and the collection of structural information. Construction of geologic maps and cross-sections. Introduction to stereographic and equal-area projections. Basic concepts of strain and stress in rock deformation.

People

Instructor: John Waldron
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Teaching assistants	Robert Dokken	CCIS 2-045	dokken @ ualberta.ca
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Office hours will be announced during the first week of classes

Technical assistance	Marilyn Huff	ESB 3-04A	huff@ualberta.ca

Places and times

Lectures CCIS 1-160 Tuesday, Thursday 12.30-13.50
Labs ESB 4-09

H1	Monday, 14.00-16.50, starting Jan 20
H2	Tuesday, 14.00-16.50, starting Jan 14
H3	Wednesday, 14.00-16.50, starting Jan 15
H4	Thursday, 14.00-16.50, starting Jan 16
H5	Friday, 14.00-16.50, starting Jan 17

You must attend your assigned lab section. If you need to change your assigned lab section in a particular week, you must request permission from your lab TA; changes will only be approved if there is space.

Prerequisites:

To take this course you must have taken either EAS 100 and 105, or EAS 210, or an approved transfer equivalent. If you have not completed either of these options, and you wish to remain in EAS 233, you *must* complete a waiver request form (available from a rack outside ESB 1-26). In the space provided, indicate the previous experience that you have that you believe will enable you to take the course. Waiver forms require instructor approval, and you must consult with me before I will approve any waiver request.

By attending this course you represent that you have completed the prerequisites or have received an official waiver from the instructor and the department.

Things you should know:

You should have completed a course in introductory geology. Here are some of the things you are expected to know.

- Maps and map scales: You should be able to convert a map scale expressed as a representative fraction (e.g. 1:50,000) to a map scale expressed in metric or imperial length units (2 cm = 1 km) and draw a **scale bar** based on either. You should understand **topographic contours** and should be able to look at a map with topographic contours and identify hills, valleys, and predict which way streams are flowing.
- Plate tectonics: Know the difference between continental and oceanic lithosphere, and the three major types of plate boundary: spreading centres, subduction zones, transform faults.
- Minerals: Common rock-forming minerals such as quartz, feldspar, mica, amphibole.
- Basic rock types: You should know the names of basic and be able to identify them. At minimum, these should include the following:
  - Igneous rocks: granite, diorite, gabbro, peridotite, rhyolite, andesite, basalt, tuff.
  - Sedimentary: conglomerate, sandstone, mudstone and shale, limestone, dolostone, coal, chert, rock salt, gypsum.
  - Metamorphic: slate, schist, gneiss, granofels, quartzite, marble.
- Geologic time: You should know the sequence of eons: Archean, Proterozoic, Phanerozoic, and within the Phanerozoic you should know the names of the eras and periods.
  - Paleozoic: Cambrian, Ordovician, Silurian, Devonian, Carboniferous (Mississippian, Pennsylvanian), Permian
  - Mesozoic: Triassic, Jurassic, Cretaceous
  - Cenozoic: Paleogene, Neogene, Quaternary

We will assume you are familiar with these terms and their meanings. If any of them are unfamiliar, now is the time to review the material from your introductory classes and make sure you know them!

Textbooks and Resources:

EAS 233 Laboratory Manual and Notes by Waldron. Available in the bookstore. Note: you must bring your manual to the first lab. Do not wait until the last minute to buy your manual. If no copies are available at the bookstore, please notify bookstore staff so that more can be printed. Copies will ***not*** be available at the lab session!

Support text: Structural Geology of Rocks and Regions by Davis, Reynolds and Kluth (Wiley).

Additional learning resources: course web site http://courses.eas.ualberta.ca/eas233
(eClass site will be used for posting marks and distributing additional material)

Previous test and exam material, illustrating the format of test questions, will be made available at the course web site.

Language: Clear comprehension and use of the English language is required both for understanding the instruction provided, and for answering written questions in labs and tests.

Rules for lectures and labs

Cell phones are to be turned off during lectures, labs and seminars. Headphones and personal audio systems may not be used in labs. (This is to ensure that you can hear and benefit from instructions from the TAs at all times.) Recording is permitted only with the prior written consent of the instructor or if recording is part of an approved accommodation plan. Bring the following items to all labs and lectures:

- Your lab manual
- Pens, pencils, eraser, etc.
- A few coloured pencils (pencil crayons) for labelling only; do not use them for accurate constructions.
- Ruler, protractor, compass (for drawing circles)
- Scientific calculator with trigonometric functions (sin, cos, tan) and their inverses. Practice accessing the required functions in the labs, so that you become familiar with your calculator. **Do not use your phone as a calculator** as you will not be allowed to use it in tests and exams.
- Metric graph paper, tracing paper (a few sheets of each).
- An old-fashioned thumb tack with a flat head. (Embed this in your eraser for safe keeping.)

Some labs include both 'graded' and 'self-assessed' questions. Graded questions will be given a numerical mark by the instructors. Self-assessed questions will be marked as 'complete' or 'incomplete' but will not be given a numerical score. Answers will be posted or discussed in a following lab. Self-assessed questions must be recorded as 'complete' before a numerical mark will be entered for the lab. Be aware that the rules for academic integrity (below) apply to all your work in labs, including both 'graded' and 'self-assessed' questions.

Rules for exams

- Your student photo I.D. is required at exams to verify your identity.
- Bring all the same drawing materials listed for labs to the exams. You may use clean copies of the Wulff and Schmidt nets from the lab manual, but no other parts of the manual. (Extra copies of the nets may be downloaded from the web site.)
- Prior to entering the room where the exam will take place, make sure you have all the necessary tools and materials in your hands. Bags and coats are to be placed in the space provided, usually at the front or the side of the room, *before you sit down*. You will not be able to access them during the exam.
- Students will not be allowed to begin an examination after it has been in progress for 30 minutes. Students must remain in the exam room until at least 30 minutes has elapsed.
- Cell phones and electronic equipment other than calculators cannot be brought into examination rooms and hats should not be worn.

Be aware of the rules for academic integrity (below) as they apply to exams and tests.

Grade Evaluation:

Grade evaluation will be by a combination of relative standing in the class and absolute achievement. This means that each assignment and test will be assigned a numerical mark and those marks will be summed using the weighting below. A final grade will be assigned based on the overall quality of the work done and where possible on natural breaks in the grade distribution, so as to be consistent in standard with previous years' grading. No absolute grade distribution ('curve') will be imposed on the grades, but the overall level and range of grades will be similar to other classes at this level at the University of Alberta.

EXAMS	WEIGHTING	DATE
Midterm #1	10%	Feb 11*, 12.30
Midterm #2	10%	Mar 18*, 12.30
Labs	40%	Weekly
Final Exam	40%	April 24**, 14.00*
Deferred examination / re-examination		May 15, 2 pm

*This date was incorrectly shown on a version of the course outline posted earlier; this version takes precedence.

**WARNING: Students must verify this date on Bear Tracks when the Final Exam timetable is published. In the event of a disagreement with this document, the Final Exam Timetable takes priority.

Unexcused late labs will be marked at 50% up to the time when marked work is returned. Thereafter, missed labs will received a mark of zero.

Missed Exams and Assignments:

A student who cannot write a **term examination or complete a lab** due to incapacitating illness, severe domestic affliction or other compelling reasons can apply to the instructor for an extension of time or a deferral of marks to another component of the course. A student who cannot write the **final examination** due to any of these reasons can apply for a deferred final examination to the student's Faculty office within 48 hours of the missed examination with a Statutory Declaration (*in lieu* of a medical statement form) or other appropriate documentation (Calendar section 23.5.6). Deferral of work and examinations is a privilege and not a right; there is no guarantee that a deferral will be granted. Misrepresentation of Facts to gain a deferral is a serious breach of the *Code of Student Behaviour*.

Reexamination:

A student who writes the final examination and fails the course may apply for a reexamination, governed by University (Calendar section 23.5.5) and Faculty of Science Regulations (Calendar section 192.5.9). Misrepresentation of Facts to gain a reexamination is a serious breach of the *Code of Student Behaviour*.

Students With Disabilities:

Students who require accommodation in this course due to a disability are advised to discuss their needs with Specialized Support & Disability Services (2-800 Students' Union Building).

Academic Support Centre:

Students who require additional help in developing strategies for time management, study skills or examination skills should contact the Academic Support Centre (2-300 Students' Union Building).

Academic integrity

All work you present for evaluation in any course must be **your own work**. It is an academic offense if you:

- present someone else's work as your own (plagiarism)
- gain an unfair advantage in a test or an exam (cheating)
- distort the truth for advantage (misrepresentation of facts)
- encourage or help anyone else to do any of these things.

In EAS 233 you will sometimes benefit from discussions with other students as well as TAs, especially in the labs. Although this discussion may help you decide **how** to solve problems in structural geology, **all the answers you write down must be written in words and sentences composed by you alone, diagrams must be drawn by you, and any measurements or calculations must be carried out separately by you**. It is not acceptable to share a calculator in determining the answers to questions. Note that these rules apply both to graded questions, for which a numerical score is awarded, and to self-assessment questions, which will be marked as complete or incomplete.

The University of Alberta is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students are particularly urged to familiarize themselves with the provisions of the *Code of Student Behaviour* (online at www.governance.ualberta.ca) and avoid any behaviour which could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence. Academic dishonesty is a serious offence and can result in suspension or expulsion from the University.

Offenses are reported to the Senior Associate Dean of Science who determines the disciplinary action to be taken. Anyone who engages in cheating, plagiarism or misrepresentation of facts these practices will receive *at minimum* a grade of zero for the exam or paper in question. The Faculty of Science sanction for cheating on any examination includes **a disciplinary failing grade** (no exceptions) and may include a suspension or expulsion from the University of Alberta.

Disclaimer: Any typographical errors are subject to change and will be announced in class.

EAS 233 Geologic Structures

Winter 2013	Provisional timetable	
Jan-06-Mon		
Jan-07-Tue	Introduction	
Jan-08-Wed		
Jan-09-Thu	Geometry Kinematics Dynamics	
Jan-10-Fri		
Jan-13-Mon		
Jan-14-Tue	Orientation of Lines and Planes	LAB 1 Orientation of lines and planes
Jan-15-Wed		LAB 1 Orientation of lines and planes
Jan-16-Thu	Stereographic projection	LAB 1 Orientation of lines and planes
Jan-17-Fri		LAB 1 Orientation of lines and planes
Jan-20-Mon		LAB 1 Orientation of lines and planes
Jan-21-Tue	Primary structures	LAB 2 Unconformities
Jan-22-Wed		LAB 2 Unconformities
Jan-23-Thu	Primary structures	LAB 2 Unconformities
Jan-24-Fri		LAB 2 Unconformities
Jan-27-Mon		LAB 2 Unconformities
Jan-28-Tue	Folds	LAB 3 Stereographic projection
Jan-29-Wed		LAB 3 Stereographic projection
Jan-30-Thu	Folds	LAB 3 Stereographic projection
Jan-31-Fri		LAB 3 Stereographic projection
Feb-03-Mon		LAB 3 Stereographic projection
Feb-04-Tue	Superimposed folds	LAB 4 Folded surfaces
Feb-05-Wed		LAB 4 Folded surfaces
Feb-06-Thu	Boudins	LAB 4 Folded surfaces
Feb-07-Fri		LAB 4 Folded surfaces
Feb-10-Mon		LAB 4 Folded surfaces
Feb-11-Tue	MID-TERM TEST 1	LAB 5 Folds 2
Feb-12-Wed		LAB 5 Folds 2
Feb-13-Thu	Fabric	LAB 5 Folds 2
Feb-14-Fri		LAB 5 Folds 2
	STUDY BREAK	
Feb-24-Mon		LAB 5 Folds 2
Feb-25-Tue	Fabric	LAB 6 Fabrics
Feb-26-Wed		LAB 6 Fabrics
Feb-27-Thu	Strain	LAB 6 Fabrics
Feb-28-Fri		LAB 6 Fabrics
Mar-03-Mon		LAB 6 Fabrics
Mar-04-Tue	Stress	LAB 7 Fractures
Mar-05-Wed		LAB 7 Fractures
Mar-06-Thu	Joints and veins	LAB 7 Fractures
Mar-07-Fri		LAB 7 Fractures
Mar-10-Mon		LAB 7 Fractures
Mar-11-Tue	Faults	LAB 8 Faults
Mar-12-Wed		LAB 8 Faults
Mar-13-Thu	Faults	LAB 8 Faults
Mar-14-Fri		LAB 8 Faults
Mar-17-Mon		LAB 8 Faults
Mar-18-Tue	MID-TERM TEST 2	Lab 9 Thrust belts
Mar-19-Wed		Lab 9 Thrust belts
Mar-20-Thu	Thrust belts	Lab 9 Thrust belts
Mar-21-Fri		Lab 9 Thrust belts
Mar-24-Mon		Lab 9 Thrust belts
Mar-25-Tue	Rifts	LAB 10 Geoscience Garden
Mar-26-Wed		LAB 10 Geoscience Garden
Mar-27-Thu	Strike-slip faults	LAB 10 Geoscience Garden
Mar-28-Fri		LAB 10 Geoscience Garden
Mar-31-Mon		LAB 10 Geoscience Garden
Apr-01-Tue	Shear zones	Weather day: Lab 10
Apr-02-Wed		Weather day: Lab 10
Apr-03-Thu	Impact structures	Weather day: Lab 10
Apr-04-Fri		Weather day: Lab 10
Apr-07-Mon		Weather day: Lab 10
Apr-08-Tue	Review	
Apr-24-Thu		2 pm: FINAL EXAMINATION*
May-09-Thu		Deferred examination/re-examination

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