

## ES2201B: Structural Geology (Jan. 2018)

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### Learning Outcomes:

Upon completion of this course, students are expected to be able to:

- Observe and document geological structures.
- Interpret geological maps in 3D using cross sections and block diagrams.
- Analyze the geometry of structures using stereographic, equal area, and orthographic projections.
- Understand the general principle of structural analysis from geometry, kinematics, to dynamics.
- Understand the general principle to relate structures to tectonic processes.

### Textbooks:

Davis, G.H., Reynolds, S.J., and Kluth, C.F. 2011. *Structural Geology of Rocks and Regions*, 3<sup>rd</sup> edition. John Wiley & Sons, Inc.

Davis, G.H., and Reynolds, S. J. 1996. *Structural Geology of Rocks and Regions*, 3<sup>rd</sup> edition. John Wiley & Sons, Inc.

Hobbs, B. E., Means, W. D. and Williams, P. F. 1976. *An Outline of Structural Geology*. John Wiley & Sons. New York. [out of print but available from the library; used copies can be found at a reasonable price from online bookstores]

You must have one of these textbooks. Textbooks will be used as an aid. Tests will be based on matters covered in lectures and labs. Reading material listed in the *Course Schedule* guides you through the use of textbooks as the course advances. You are strongly encouraged to read all of the suggested materials as they will help you understand the concepts as well as provide supporting and/or supplemental information.

### Course Description and Goals:

Structural Geology is concerned with such features in Earth's crust and mantle as folds, faults, shear zones, and other *structures*. These features are products of past or ongoing deformation of the earth. Structural studies enable us to understand Earth's properties, history, and processes. Knowledge of bedrock structure is critical for land use, resource exploration and mining, and natural hazard mitigation. This is a first course in structural geology. We shall cover: 1) how to observe and describe structures, 2) how to collect, process, and present structural data, 3) how to apply basic mechanical concepts to understand the formation of structures, and 4) how to reconstruct deformation history from structural studies. The learning outcomes of this course are summarized above.

### Pre-/Co-requisite: ES2200A/B

Please note "Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This

decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.”

**Course Format:** 2 lecture hours, 3 laboratory hours

Lectures: Tuesdays and Thursdays 9:30AM to 10:30AM, KB-K103

Labs: Mondays 2:30PM – 5:30PM, BGS 1015

**Grading:**

Lab assignments	20%
Lab Test	20%
Lecture exams 15% x 2	30%
Final Exam	30%

**Conduct:**

- Please make every effort to be on time for classes and labs.
- If you are late or have to leave before a class is over, please try not to distract others as much as possible.
- Absolutely no smart phone use during lectures.

“Scholastic offenses are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offense, at the following Web site: [www.uwo.ca/univsec/pdf/academic\\_policies/appeals/scholastic\\_discipline\\_undergrad.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf)”

**Absence from course commitments**

*A. Attendance/Examinations*

Attendance to lectures and labs are required. Any student who, in the opinion of the instructor, is absent too frequently from class or laboratory periods, will be reported to the Dean of the Faculty of Science (after due warning has been given). On the recommendation of the department concerned, and with the permission of the Dean, the student will be debarred from taking the regular examination in the course. The Dean will communicate that decision to the Dean of the Faculty of Registration.

A student may be debarred from writing the final examination for failure to maintain satisfactory academic standing throughout the course. This includes unsatisfactory performance on lab assignments and/or mid-term exams.

*B. Absence for medical illness:*

Students must familiarize themselves with the Policy on Accommodation for Medical Illness: <https://studentservices.uwo.ca/secure/index.cfm>

Statement from the Dean’s Office, Faculty of Science:

If you are unable to meet a course requirement due to illness or other serious circumstances, you must provide valid medical or other supporting documentation to the Dean's office as soon as possible and

contact your instructor immediately. It is the student's responsibility to make alternative arrangements with their instructor once the accommodation has been approved and the instructor has been informed. In the event of a missed final exam, a "Recommendation of Special Examination" form must be obtained from the Dean's Office immediately. For further information please see: [www.uwo.ca/univsec/pdf/academic\\_policies/appeals/accommodation\\_medical.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf).

A UWO Student Medical Certificate (SMC)\* is required where a student is seeking academic accommodation due to illness. This documentation should be obtained at the time of the initial consultation with the physician or walk-in clinic. An SMC can be downloaded from:

[http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/medicalform.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf)

Hard copies are available from Academic Counselling in the Dean's Office

### *Failure to Appear at an Examination*

Students who fail to appear for an examination will not be allowed to write the examination paper thus missed. Students should report this irregularity immediately to the office of their dean or, in cases of evening or Saturday examinations, to the Office of the Registrar. They may, with the approval of the chair of the department concerned, petition their dean for permission to write a Special Examination.

A Special Examination is any examination other than the regular examination, and it may be offered only with the permission of the Dean of the Faculty in which the student is registered, in consultation with the instructor and Department Chair. Permission to write a Special Examination may be given on the basis of compassionate or medical grounds with appropriate supporting documents. A Special Examination must be written at the University or an Affiliated University College no later than 30 days after the end of the examination period involved. To accommodate unusual circumstances, a date later than this may be arranged at the time permission is first given by the Dean of the Faculty. The Dean will consult with the instructor and Department Chair and, if a later date is arranged, will communicate this to Registrarial Services. If a student fails to write a scheduled Special Examination, permission to write another Special Examination will be granted only with the permission of the Dean in exceptional circumstances and with appropriate supporting documents. In such a case, the date of this Special Examination normally will be the scheduled date for the final exam the next time the course is offered.

### **Accessibility Statement**

Please contact me if you require material in an alternative format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.

## Course Schedule<sup>1</sup>

Date	Activity/Lecture Topic	Reading
Jan 9	Lecture 1: Introduction and Setup	<i>Course Syllabus</i> <i>p.1-9 of DR<sup>2</sup> or</i> <i>p.2-21 of DRK<sup>3</sup></i> Introduction (HMW <sup>4</sup> )
Jan 11	Lecture 2: Orientation of Planes and Lines, Geological Contacts and Primary Structures	<i>p. 662-669 of DR</i> <b>or</b> <i>p.711-718 of DRK</i> <b>Plus</b> Chapter 3 of HMW
Jan 15	<b>Lab 1</b>	<i>p. 669-674 of DR or</i>
Jan 16	Lecture 3: Geological Maps, Cross Sections	<i>p.718-723 of DRK</i>
Jan 18	Lecture 4: Block Diagrams, Stereographic and Equal-area Projections	<i>p. 691-704 of DR or</i>
Jan 22	<b>Lab 2</b>	<i>p. 735-747 of DRK or</i>
Jan 23	Lecture 5: Summary of Maps and Projections	<i>p. 483-501 of HMW</i>
Jan 25	Lecture 6: Fractures and Sealed Fractures	
Jan 29	<b>Lab 3</b>	<i>p.193-220; 249-259; 272-280</i>
Jan 30	Lecture 7: Faults 1	<i>of DRK or</i>
Feb 1	Lecture 8: Faults 2	<i>p.204-226; 269-279; 292-300</i>
Feb 5	<b>Lab 4</b>	<i>of DR or</i>
Feb 6	Lecture 9: Brittle Fault Rocks	<i>p. 289-302 of HMW</i>
Feb 8	Lecture 10: Mechanical Aspects of Fracturing	<i>p. 260-267 of DRK or</i> <i>p. 280-286 of DR</i>
Feb 12	<b>No Lab: Study for Exam one</b>	
Feb 13	Lecture 11: Summary of Fractures	
<b>Feb 15</b>	<b>Exam One</b>	
Feb 26	<b>Lab 5</b>	
Feb 27	Lecture 12: Fault Systems 1	
Mar 1	Lecture 13: Fault Systems 2	
Mar 5	<b>(No Lab, PDAC)</b>	
Mar 6	Lecture 14: Folds 1: Geometrical Elements	<i>p.380-391 of DR or</i>
Mar 8	Lecture 15: Folds 2: Classification and Map Patterns	<i>p.351-368 of DRK</i>
Mar 12	<b>Lab 6</b>	
Mar 13	Lecture 16: Kinematics and Mechanics of Folding	<i>p.397-410 of DR or</i> <i>p.383-404 of DRK</i>
Mar 15	Lecture 17: Generations, Styles, and Overprinting	<i>p.348-374 of HMW</i>
Mar 19	<b>Lab 7</b>	
Mar 20	Lecture 18: Fabrics: Foliations and Lineations	<i>p. 424-436; 453-460 of DR or</i>
Mar 22	Lecture 19: Fabrics Associated with folds	<i>p. 463-475; 487-497 of DRK or</i> <i>Chapters 5 &amp; 6 (HMW)</i>
Mar 26	<b>Lab 8</b>	
Mar 27	Lecture 20: Shear Zones	<i>p.461-463; 493-510 of DR</i>
Mar 29	Lecture 21: Fabrics in Ductile shear zones	<i>p. 542-550 of DR</i>

<sup>1</sup> Minor changes may be necessary as the course advances. Please check the course site for an updated version.

<sup>2</sup> DR stands for the textbook by Davis, GH and Reynolds, SJ.

<sup>3</sup> DRK stands for the textbook by Davis, GH, Reynolds, SJ, and Kluth, CF.

<sup>4</sup> HMW stands for the textbook by Hobbs, BE, Means, WD, and Williams, PF.

		p. 515-518; 530-540 of DRK; p. 556-586 of DRK
<b>April 2</b>	<b>Lab Exam</b>	
April 3	Lecture 22: Ductile Fault Rocks	
April 5	Lecture 23: Principles of Structural Analysis	Provided in course site
April 9	<b>Exam Two</b>	

**Lab exercises:**

- Each lab assignment is due before the following lab begins.
- You may discuss lab questions with classmates but you must complete lab questions by yourself. Copying other's lab work in part or whole constitutes plagiarism.
- Please *do not* use a new lab session to complete previous lab assignments.
- Overdue labs will not be accepted for credit unless with prior permission from the TAs.