

Earth Science 2281B - Geology for Engineers – 2014

Description: Introduction to physical geology with emphasis on the engineering oriented aspects of the Earth Sciences. Topics include; minerals and rocks; mass movements; interpretation of aerial photographs, topographic and geologic maps; surficial processes and their manifestations; surface and ground water; structural geology and subsurface processes; and earth resources. 2 lecture hours, 3 laboratory hours (0.5 course)

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T.A.'s (laboratories): TDB

Antirequisites: Earth Science 1022a/b, 1081a/b, 1082a/b, or 1023/2123 a/b

Prerequisites: Register in second, third, or fourth year Civil and Environmental Engineering or permission of department

- *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.*
- *Accessibility Statement: Please contact the course instructor if you require material in an alternate 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 Outline: Lecture Topics

- 1) Course objectives and relevance to Engineering
- 2) Rock cycle; Earth's internal structure; Earth Dynamics
- 3) Minerals: composition, structure, groups
- 4) Igneous rocks
- 5) Volcanoes and intrusive igneous activity
- 6) Weathering and soil
- 7) Sedimentary rocks
- 8) Sedimentary environments
- 9) Metamorphism and metamorphic rocks
- 10) Geologic Time
- 11) Crustal deformation & structures
- 12) Earthquakes – faults, seismology, case studies
- 13) Mass Wasting and slope processes
- 14) Surface water and river processes
- 15) Stream erosion, deposition, drainage networks
- 16) Ground water – environments and movement
- 17) Ground water – springs, wells, contamination
- 18) Glaciers – deposition and landforms
- 19) Glacial deposition and landforms
- 20) Energy and Mineral Resources
- 21) Geology of Canada

Laboratory Exercises

- Mineral properties and identification
- Igneous rock identification (ID)
- Sedimentary rock ID
- Metamorphic rock ID; core RQD; PN
- Lab Exam #1
- Geologic Time & Structures
- Topographic maps and aerial photos
- Stream processes, mass wastage, floods
- Ground water flow & environments
- Glacial processes and landforms
- Lab Exam #2 forms part of final exam

Required textbooks

EARTH - An Introduction to Physical Geology, 3rd Canadian Edition, Tarbuck, Lutgens, Tsujita, Hicock, Pearson, ISBN-13: 9780132611114

Laboratory Manual in Physical Geology, 9th Edition, Richard M. Busch, American Geological Institute
National Association of Geoscience Teachers, Pearson, ISBN-13: 9780321689573

Textbook & Laboratory Manual are **REQUIRED**:

1. Majority of figures & tables used in lectures come from textbook.
2. **All** students are required to submit *worksheets* (questions, coloured maps / airphotos) directly from laboratory exercise manual. No black & white photocopies of required manual pages will be accepted.
3. The textbook and lab manual have been packaged together at the bookstore for a substantial savings. However, the UWO bookstore has also brought in the lab manuals separately if you choose to purchase a used textbook.

Required materials

For the mineral and rock identification laboratories you will require a 10x hand lens (magnifying glass). For the map exercises you will require a millimeter ruler, coloured pencils, protractor, and calculator

Lecture Material: The text portion of the lecture presentation slides will be made available on OWL. Figures used in the lectures come from the textbook, various web links, government sources, or various consulting reports. Text figures, or material with disclosure issues (e.g. consulting reports), will not be posted on OWL. You are expected to attend lectures and make additional notes to augment the text provided. The main purpose of the lectures is to help you understand how Earth Sciences and Civil Engineering are closely linked. Case studies / consulting reports give you the real world application demonstrating these links. The lectures also help you focus on what the instructor feels is important in the textbook.

Lectures: Tues & Thurs 9:30 – 10:20 a.m. PAB 148

Laboratories: Section 002 - Wed. 1430 to 1730 hrs, rm. 1015 BGS

Section 003 - Wed. 1800 to 2100 hrs, rm. 1015 BGS

Exams and Mark Distribution: Exams will be closed book (definitions; short answer; problem solving). A pencil, ruler, eraser, and basic calculator (basic math & geometry functions; but no extensive non-volatile memory capability). *A calculator is to be used for calculations only and not storage of information - any recall of such stored information will be considered a scholastic offense (cheating). Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:*

<http://www.uwo.ca/univsec/handbook/appeals/scholoff.pdf>

Lab exam #1	15%	February 12 (during lab)
Midterm	25%	February 25 (6:30 to 8:30 p.m., room TBD)
In lab Assignments	10%	
Presentations	10%	Feb. 27, Mar. 6, 13, 20, 27 (in-lab)
Final exam	40%	(25% lecture material; 15% lab exam #2; 3 hours total for both)

Class Presentations

Groups of three students will choose one of the following components of the course and give a group presentation (projection unit with computer & PowerPoint will be provided) on an application of the component to Civil and Environmental Engineering. For example for “Minerals” you would give an application where Minerals are of importance to Civil and Environmental Engineering. For this topic examples could range from materials engineering (steel & concrete corrosion) to the environmental impacts of mine tailings deposits (sulphite mineral oxidation). Do not simply repeat material that was presented in the lectures. You will be allowed 10 minutes for the talk and 2 minutes for questions from the audience. You will be given a 1 minute warning and cut off at 10 minutes if you do not conclude the talk on your own.

To select your topic:

- Use the Dropbox on the 2281b Owl website to submit a list of three preferences listing the component and date of presentation. List the three members of your presentation group. Only one person in each group should submit the topic & member list. Submit your topic / list by Feb 6 – ‘first come first selected’ so the earlier you submit the better your chances of getting the topic you want. Those students not represented in a group by Feb 6 will receive a 0. If you are having difficulty finding a group email schincarc@uwo.ca prior to Feb 6 and you will be assigned to a group.

Grading will be based on (all members of the group will get the same grade):

1. Presentation Form: clearly and concisely presented; good eye contact with audience; good volume and not monotone; steady and appropriate rate; not overly dependent on notes; participation of all group members in talk; clear slides – readable from back of room, not overly complex. /5

2. Content: at appropriate level for class; engaging all audiences (e.g. scientists & engineers); interesting and engaging; fulfilled objectives of showing how the particular component of the hydrologic cycle is important in your field of study. /4
3. Duration: 10 minute presentation + 2 minutes for questions; too short or if cut off will result in lower mark. /2
4. Questions: answered questions appropriately. /2

Components:

Only a maximum of two groups in each section can give a presentation on one of the components. Schedules will be made so at least one group presents on one of the two topics for each lab.

Group 1 (Feb 26): Minerals; Igneous Rocks / Processes

Group 2 (Mar 5): Sedimentary Rocks / Processes; Metamorphic Rocks / Processes

Group 3 (Mar 12): Crustal Deformation / Earthquakes; Mass Wasting / Slope Processes

Group 4 (Mar 19): Surface Water / River Processes; Ground Water

Group 5 (Mar 26): Glacial Materials / Processes; Energy Resources

Laboratory Outline

An assignment will be given for each laboratory session which will have two components. Assigned pre-lab reading and questions from the laboratory manual should be worked on prior to and during the scheduled laboratory time. While answers to these questions will be provided on OWL you are to use these only to check your work – not copy. Near the end of the lab an additional question will be handed out which must be completed and handed in by the end of the lab. This question will be graded. The laboratory exams form a large component of the course (30%); material will be similar to the assigned questions thus it is very important to understand the lab material.

➤ *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: <http://www.uwo.ca/univsec/handbook/appeals/medical.pdf>*

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Lab	Date	Topic	Prelab Assignment (AGI Lab Manual)	Assignment During Lab (AGI Lab Manual 9 th Ed.)
1	Jan. 15	Mineral Properties and Identification	Read Lab Three	Activity 3.4* *samples 1-15, 17, 18, 21, 22, 25 (see key)
2	Jan. 22	Global Rock Cycle; Igneous Rocks and Identification	Read Lab Four, do Activity 4.1; Read Lab Five, do Activity 5.3	Activity 5.5* (lab 5) *samples I-1, 2, 4-11, 13 (see key)
3	Jan. 29	Sedimentary Rocks, Processes and Identification	Read Lab Six, do Activity 6.4, 6.6, 6.9	Activity 6.5* *samples S-2 to 9, 11, 13, 15, 16 (see key)
4	Feb. 5	Metamorphic Rocks, Processes and Identification + Core Recovery / RQD + PN	Read Lab Seven, Read Core Loss and RQD handout (see OWL)	Activity 7.2*, *samples M-1 to 5, 8 (see key); complete lab 4 handout on cores & PN.
	Feb. 12	<i>Laboratory Exam I</i>	<i>Bring hand lens</i>	<i>Lab Manual Open book You will only have two minutes to identify each sample (approx. 35 samples)</i>
5	Feb. 26	Geologic Time & Events Geologic Structures <i>Presentations 1</i>	Read Lab Eight, Read Lab 10, form cardboard models 1, 2, 3, and 6; work ahead on questions →	Lab 8 – Activity 8.1, 8.4, 8.6, 8.7; Lab 10 – Activity 10.1, Activity 10.4 (A-C & F), Activity 10.5
6	Mar. 5	Topographic Maps and Aerial Photographs <i>Presentations 2</i>	Read Lab nine, work ahead on questions →	Activity 9.1 B,G, J, Activity 9.2 Activity 9.3 Activity 9.6
7	Mar. 12	Stream Processes, Landscapes, Mass Wastage, and Flood Hazards <i>Presentations 3</i>	Read Lab Eleven, work ahead on questions →	Activity 11.1 (D & E), Activity 11.2, Activity 11.3 (A-C), Activity 11.4 (A-E)
8	Mar. 19	Ground Water <i>Presentations 4</i>	Read Lab Twelve, work ahead on questions →	Activity 12.1 B-D, Activity 12.3 (A, B1, B2, B5, B8, B10, B12)
9	Mar. 26	Glacial Processes and Landforms <i>Presentations 5</i>	Read Lab Thirteen, work ahead on →	Activity 13.1B, 13.2, 13.3 (A-C); 13.3 use Fig. 13.12 Airphoto set provided by GTA: 1. Using the drumlins determine the direction of glacier movement. 2. List other glacial features you can see on the airphotos.

Mineral and Rock Name Key

Minerals

- 1 Talc
- 2 Gypsum
- 3 Calcite
- 4 Fluorite
- 5 Halite
- 6 Quartz: massive/crystal
- 7 Garnet:massive/crystal
- 8 Hornblende (Amphibole)
- 9 Augite(Pyroxene)
- 10 Orthoclase(K Feldspar)
- 11 Plagioclase(Labradorite)
- 12 Muscovite
- 13 Biotite
- 14 Hematite
- 15 Magnetite
- 17 Pyrite
- 18 Chalcopyrite
- 21 Galena
- 22 Graphite
- 25 Olivine

Igneous Rocks

- I-1 Obsidian
- I-2 Rhyolite
- I-4 Granite
- I-5 Granite
- I-6 Granite
- I-7 Diorite
- I-8 Basalt
- I-9 Gabbro
- I-10 Volcanic Breccia
- I-11 Pumice
- I-13 Andesite Porphyry

Sedimentary Rocks

- S-2 Fossiliferous Limestone
- S-3 Oolitic Limestone
- S-4 Dolostone (Dolomite)
- S-5 Rock Gypsum
- S-6 Coal
- S-7 Shale
- S-8 Chalk
- S-9 Conglomerate
- S-11 Quartz Sandstone
- S-13 Siltstone
- S-15 Chert
- S-16 Rock Salt

Metamorphic Rocks

- M-1 Marble
- M-2 Slate
- M-3 Gneiss
- M-4 Quartzite
- M-5 Schist
- M-8 Phyllite