

Earth Science 2281B - Geology for Engineers – 2015

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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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) Jan 06 - Course objectives and relevance to Engineering
- 2) Jan 08 - Rock cycle; Earth's internal structure; Earth Dynamics
- 3) Jan 13 - Minerals: composition, structure, groups
- 4) Jan 15 - Igneous rocks
 - group 1 presentation
- 5) Jan 20, 22 - Weathering and soil
 - group 2 presentation
- 6) Jan 27 - Sedimentary rocks & Environments
 - group 3 presentation
- 7) Jan 29 - Metamorphism and metamorphic rocks
 - group 4 presentation
- 8) Feb 03 - Geologic Time
 - group 5 presentation
- 9) Feb 05 - Crustal deformation & structures
 - group 6 presentation
- 10) Feb 10, 12 - Earthquakes – faults, seismology, case studies
 - group 7 and 8 presentations (both Feb 12)
- 11) Feb 24, 26 - Mass Wasting and slope processes
 - group 9 and 10 presentations (both Feb 26)
- 12) Mar 03, 05 - Surface water and river processes
 - group 11 and 12 presentations (both Mar 05)
- 13) Mar 10, 12 - Groundwater – movement, contamination
 - group 13 and 14 presentations (both Mar 12)
- 14) Mar 17, 19 - Glaciers – processes and landforms
 - group 15 and 16 presentations (both Mar 19)
- 15) Mar 24, 26 - Energy and Mineral Resources
 - group 17 and 18 presentations (both Mar 26)
- 16) Mar 31, Apr 2 – Coastal Processes, hazards, risks
 - group 19 and 20 presentations (both Apr 2)

Apr 7 – Buffer lecture (if needed).

Laboratory Exercises

- Jan 14 Mineral properties and identification
- Jan 21 Igneous rock identification (ID)
- Jan 28 Sedimentary rock ID
- Feb 04 Metamorphic rock ID; core RQD; PN
- Feb 11 Relative age dating + topographic maps
+ air photo interpretation
- Mar 04 Geologic Structures, maps, block diagrams
- **Feb 25 midterm lecture and lab exam (2:30 to 5:30 p.m. sections 002 and 003)**
- Mar 11 Stream processes, mass wastage, floods
- Mar 18 Groundwater processes, resources, risks
- Mar 25 Glacial processes and landforms
- Apr 01 Lab pickup for final exam

Required textbooks

Laboratory Manual in Physical Geology plus MasteringGeology with eText – Access Card Package, 10th Edition, Richard M. Busch, American Geological Institute, National Association of Geoscience Teachers, Pearson, 2015, ISBN-13: 9780321944528

Laboratory Manual IS 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. MasteringGeology will be used in conjunction with the lectures and labs.

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 106

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/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf

Midterm	40%	Feb 25, 2:30 to 5:30 p.m. (25% lecture material; 15% lab exam#1)
In lab Assignments	10%	9 assignments
Presentations	10%	
Final exam	40%	(25% lecture material; 15% lab exam #2; 3 hours total for both)

Class Presentations

Groups of three to four students will choose one of the components of the course (listed above) 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 – focus your talk on applications or a case study. You will be allowed 8 minutes for the talk and 2 minutes for questions from the audience. You will be given a 1 minute warning and cut off at 8 minutes if you do not conclude the talk on your own.

To select your topic:

- Use the 2281b Owl website (Assignments) to submit a list of three preferences listing the component and date of presentation. List the three to four members of your presentation group. Only one person in each group should submit the topic & member list. Submit your topic / list by Jan 8 – ‘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 Jan 8 will receive a 0. If you are having difficulty finding a group email schincarc@uwo.ca prior to Jan 8 and you will be assigned to a group.

- By 6 p.m. the day prior to your presentation day you must submit your PowerPoint (or equivalent format) presentation via the Owl website (Assignments). The presentations will be uploaded to the classroom computer and will be used for grading purposes.
- 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: 8 minute presentation + 2 minutes for questions; too short or if cut off will result in lower mark. /2
 4. Questions: answered questions appropriately. /2

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 the Policy on Accommodation for Medical Illness at:*

<https://studentservices.uwo.ca/secure/index.cfm>

➤ *For work worth less than 10% (e.g. individual assignments) if accommodation is required for medical or non-medical reasons email the instructor. In these cases either an extension will be given or a re-weighting to other components of the course – at the instructors discretion – will be done.*

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Lab	Date	Topic	Prelab Assignment (AGI Lab Manual)	Assignment During Lab (AGI Lab Manual 9 th Ed.)
1	Jan. 14	Mineral properties and identification	Read Lab 3 p.74-86	Activity 3.4* p.88 *samples 1-15, 17, 18, 21, 22, 25 (see key)
2	Jan. 21	Igneous rocks and identification	Read Lab 5 p.130-135, do Activity 5.1, 5.2, 5.3	Activity 5.8 *samples I-1, 2, 4-11, 13 (see key)
3	Jan. 28	Sedimentary rocks, processes and identification	Read Lab 6 p.154-168, do Activity 6.1, 6.2, 6.5	Activity 6.6*, 6.7 *samples S-2 to 9, 11, 13, 15, 16 (see key)
4	Feb. 4	Metamorphic rocks, processes and identification + core recovery / RQD + PN	Read Lab 7 p.187-198, do Activity 7.1, 7.2 Read Core Loss and RQD handout (see OWL)	Activity 7.3*, *samples M-1 to 5, 8 (see key); complete lab 4 handout on cores & PN.
5	Feb. 11	Relative age dating, geologic structures, maps, block diagrams	Read Lab 8 p.208-214, Read Lab 10 p.260-272 form cardboard models 1, 2, 3, and 6; work ahead on questions →	Lab 8 – Activity 8.2, 8.6 Lab 10 – Activity 10.2, 10.4, 10.5(a,b,c,e), 10.6(a to i)
	Feb. 25	midterm lecture and lab exam 2:30 to 5:30 p.m. Section 002 and 003		
6	Mar. 4	Topographic maps, air photo interpretation	Read Lab 9 p.228-247, work ahead on questions→	Activity 9.2(a,d,e,f,g4) Activity 9.4b Activity 9.5 Activity 9.6
7	Mar. 11	Stream Processes, mass wastage, and flood hazards	Read Lab 11 p.283-296, work ahead on questions→	Activity 11.2 (a, d, e), Activity 11.4 , Activity 11.5 (a-c), Activity 11.6 (a-e)
8	Mar. 18	Groundwater processes, resources, risks	Read Lab 12 p.311-320, work ahead on questions →	Activity 12.2(b-d), Activity 12.3 (a-f), 12.4a
9	Mar. 25	Glacial processes and landforms	Read Lab 13 p.329-337, work ahead on →	Activity 13.2, 13.3, 13.4 Airphoto set provided by GTA:
<p>The airphoto pair provided is of an area in the Peterborough region similar to that seen in Figure 13.12. Consider the shape, orientation, and grouping of the dominant glacial landforms on the airphoto and answer the following questions:</p> <p>a) <u>On your left airphoto</u> outline and identify / name two of these landforms, and using these landforms show the direction of glacier movement (use an arrow).</p> <p>b) Can you locate any eskers, kames or kettle lakes in the area? If so circle and identify one of each on the left airphoto pair.</p>				
	Apr. 01	Lab pickup for final exam		

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