

Earth Science 2281B - Geology for Engineers – January 2016

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)

Instructor: Rob Schincariol, Ph.D., P.Eng., P.Geo.

0174 Biological and Geological Building; 519-661-2111 ext. 83732; schincar@uwo.ca

T.A.'s: Joelle Langford jlangfo8@uwo.ca, Sarah CoDyre scodyre@uwo.ca, Emma-Dawn Ferguson efergu8@uwo.ca

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	Laboratory Exercises
Jan. 05 – Course objectives and relevance to Engineering – Rock cycle; Earth’s internal structure; Earth Dynamics	
Jan. 12 – Minerals: composition, structure, groups – Igneous Rocks	Jan. 13 – Mineral properties and Identification
Jan. 19 – Weathering and Soil	Jan. 20 – Igneous Rock Identification
Jan. 26 – Sedimentary Rocks and Environments	Jan. 27 – Sedimentary Rock Identification
Feb. 02 – Metamorphism and Metamorphic Rocks – Geologic Time	Feb. 03 – Metamorphic Rock Identification, RQD, PN
Feb. 09 – Crustal Deformation and Structures – exam review	Feb. 10 – Laboratory Exam (minerals and rocks)
Feb. 23 – Midterm exam; in-class; see Owl announcement for assigned room location.	Feb. 24 – Relative Age Dating, Topographic Maps, Air Photo Interpretation
Mar. 01 – Earthquakes – faults, seismology, case studies	Mar. 02 – Geologic Structures, Maps, Block Diagrams
Mar. 08 – Mass Wasting and slope processes	Mar. 09 – Stream processes, mass wastage, floods
Mar. 15 – Surface water and river processes	Mar. 16 – Groundwater processes, resources, risks
Mar. 22 – Groundwater – movement, contamination	Mar. 23 – Glacial processes and landforms
Mar. 29 – Glaciers – processes and landforms	Mar. 30 – Lab pickup for final exam
Apr. 05 – Energy and Mineral Resources	Apr. 06 – No Lab

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. A large number of figures / tables used in lectures are from lab manual and will not be reproduced in the lecture notes.
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 lab manual, various web links, government sources, or consulting reports. 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 guide you through the lecture material. 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.

Lectures: Tues & Thurs 9:30 – 11:20 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://westerncalendar.uwo.ca/2015/pg113.html>

Mid-Lab exam	15%	Feb. 10
Midterm exam	30%	Feb. 23 (during normal class 9:30 to 11:20 a.m.; see Owl for rooms)
In lab assignments	10%	9 assignments
Final exam	45%	(30% lecture material; 15% lab exam #2; 3 hours total for both)

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. During the lab additional questions will be handed out which must be completed, along with the lab manual assigned questions, and handed in by the end of the lab. These additional questions will be graded provided you have completed the questions assigned from the laboratory manual. While answers to questions will be provided on OWL you are to use these only to check your work – not copy. Handing in answers from previous years or other sources will be considered a Scholastic Offence and handled according to normal policies see <http://westerncalendar.uwo.ca/2015/pg113.html>

➤ *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 10 th Ed.)	Assignment During Lab (AGI Lab Manual 10 th Ed.); <i>GTA's will provide additional samples & questions for each lab</i>
1	Jan. 13	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. 20	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. 27	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. 3	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. 10	Rock and Mineral lab exam	Bring your lab manual only – no additional sheets allowed	Bring your hand lens
	Feb. 24	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)
6	Mar. 02	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. 09	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. 16	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. 23	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> <ol style="list-style-type: none"> On your left airphoto outline and identify / name two of these landforms, and using these landforms show the direction of glacier movement (use an arrow). 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. 				
	Mar. 30	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-4 Quartzite
M-2	Slate	M-5 Schist
M-3	Gneiss	M-8 Phyllite