

STUDENT GUIDE

GEOLOGICAL ENGINEERING

University of British Columbia

2017-2018

Introduction

The purpose of this guide is to give you information about the structure and course requirements in the Geological Engineering program. You should use this guide to help you plan your degree program. However, as our program evolves, curriculum changes will be made and this guide may become outdated. The official program is the one posted online in the UBC Calendar. [Click here](#) to access the [2017 - 2018 Geological Engineering entry in the UBC Calendar](#).

Our program is structured as a single set of course requirements that all students must fulfill to graduate. However, there are a number of electives that you may choose to help you tailor the program to your individual interests. This guide will help you select those electives. For additional information, you can also consult the Geological Engineering website: <http://www.geoeng.ubc.ca/>.

Administrative Structure of the Program

Geological Engineering is an interdisciplinary program that is housed in the Department of Earth, Ocean and Atmospheric Sciences (Faculty of Science), but is under the jurisdiction of the Dean of Applied Science, and administered by a Board of Study. The undergraduate program leads to a B.A.Sc. or "Engineering" Degree. This degree can be obtained with or without participation in the Co-Op program. All graduates from the program will receive the designation "B.A.Sc. in Geological Engineering" on their degree. All graduates are eligible for registering as a P.Eng. after meeting the professional experience, law and ethics requirements set out by the governing body in the jurisdiction you wish to register in (e.g. APEGBC).

Getting Help

There are several sources of help and advising for the program. Degree Navigator is an easy to use tool that will allow you to track your program, the course requirements you have fulfilled, and those still required for graduation. Details on how to use Degree Navigator can be found at: <http://students.engineering.ubc.ca/how-use-degree-navigator>. Remember, Degree Navigator is a tool and not the official record of whether you have fulfilled your degree requirements.

For questions regarding the program, advising, or approval of courses and technical electives, please contact the **Director of Geological Engineering, Dr. Erik Eberhardt** (erik@eoas.ubc.ca, 604-827-5573, EOS-South 251).

For questions related to registration in EOSC courses, contact the **Undergraduate Program Coordinator**, the kind and most helpful **Alicia Warkentin** (awarkentin@eoas.ubc.ca, 604-822-3146, ESB 2020).

For questions related to registration in courses in other departments, please contact these departments directly. For CIVL courses, please consult their FAQ and online course request form at: <http://www.civil.ubc.ca/academic-programs/undergraduate-program/undergraduate-academic-program-faq#registration>. For MINE courses, contact their main office: <http://mining.ubc.ca/contact/>.

For questions related to transfer credits, yet-to-be-completed first year requirements or program requirements listed as “complementary studies” electives, contact **Engineering Student Services** in the lobby of the Kaiser Building (604-822-6556).

For questions related to Co-Op, Go Global, Coordinated International Exchange, etc., contact the respective offices for these. And lastly, for the student perspective on courses and other student experiences, talk to **senior GeoRox students** in the program. They are a great resource!

Program Requirements

We are always looking for ways to improve the Geological Engineering program, resulting in periodic changes to the courses needed to fulfill the degree requirements. This can sometimes get a bit confusing. The rule is that you must complete a given year in your program as it appears in that year’s UBC Calendar when you received standing for the year you are in. For example, if you receive 3rd year standing in 2017/18, you must complete the 3rd year program as it appears in the 2017/18 calendar. If you received 3rd year standing in 2016/17 but are completing part of 3rd year in 2017/18 due to Co-Op or Exchange, you must complete your 3rd year program as it appeared in the 2016/17 calendar.

Your Degree Navigator should be programmed for this and is a useful guide to help you track which courses need to be completed. However, errors do occur in Degree Navigator and the UBC Calendar is the official record of what needs to be completed. If you have any questions regarding this, or would like permission to substitute an older program requirement with a newer option, please contact the Geological Engineering Director.

Field Schools and Time Tabling

There are two field-school courses in the program: EOSC 223 *Field Techniques*, and one of either EOSC 328 *Field Geology* or EOSC 428 *Field Techniques in Groundwater Hydrology*. These field schools run after final exams in April at the end of 2nd year and 3rd year, respectively. Note that if you need to take a field school at the end of fourth year, grades will be provided in time for spring convocation, but there may be some extra administrative red tape.

Tailoring the Program to Your Interests

The graduation requirements for the program are provided in the UBC Calendar as well as here in Table 1. If there are any discrepancies, please note that the online UBC Calendar is the official record of the courses required for completing the program relative to the year you receive standing in each year of your program (see note above on *Program Requirements*). As you will see, in second

year all courses are core and there are no electives. The second year courses serve as the foundation for your third and fourth year courses. In third and fourth year you can select from a wider range of courses and technical electives.

It is by choosing your electives that you can tailor the program to your interests. In Table 2 of this document we have provided a list of pre-approved technical elective courses. This list, however, is not comprehensive and there may be courses you are interested in that are equally acceptable. Please seek the formal approval of the Geological Engineering Director via email before you enroll in a technical elective course if it is not listed here, to ensure that it meets program requirements.

Example Program Streams

You will graduate as a Geological Engineer as long as you satisfy the requirements of the program as outlined in the UBC calendar. As a guide to help you specialize, we describe three areas of interest in Geological Engineering: i) Geotechnical, ii) Environmental, and iii) Natural Resources. You may choose to follow one of these, or to mix and match courses to sample a little from each.

Geotechnical interest:

Broadly speaking, this is the application of engineering and geological understanding to the needs of civil, mining, and oil & gas projects (site investigations, engineering design, project planning and construction, environmental management and control, etc.). Technical electives you will want to consider include those that provide additional soil and rock mechanics (e.g., MINE 403), geological mapping (e.g., EOSC 328 instead of EOSC 428), and specifics regarding geotechnical practice in different industrial settings (e.g., MINE 485). You will gain skills relevant to the design of foundations, tunnels, surface and underground mines, shale gas reservoirs, natural hazard mitigation works, hydroelectric dams, highway/railway/pipeline routes, slope stabilization, forestry and many other important projects. You will be able to find employment in consulting companies, construction, mining and energy production firms, as well as government.

Environmental interest:

The technical electives you will want to consider are similar to those for Geotechnical, so you will be able to work on many of the same projects as mentioned above. However, additional courses related hydrogeochemistry and groundwater remediation (e.g., EOSC 430, 431), hydrogeological field investigations (e.g., EOSC 428 instead of EOSC 328), water resource engineering (e.g., CIVL 415, 416), and the design of landfills and environmental cleanup (e.g., CIVL 405, 406, 408) may be of interest. Your employment prospects will also be similar to those of your Geotechnical colleagues, including consulting and mining/oil & gas companies who have specialized environmental groups.

Natural Resources interest:

This specialization trains Professional Engineers for work in the Mineral or Petroleum exploration industries. You will still obtain basic engineering skills to allow you to work in functions described under Geotechnical and Environmental, but you will focus more on geology and economics of ore deposits and fossil fuels (e.g., EOSC 331, 421), and geological mapping (e.g., EOSC 328 instead of EOSC 428). You will be able to find employment with companies involved directly in resource exploration, development and production, or with companies providing services such as mineral resource consulting.

Mix and Match interest:

If your interests are broad and you would like exposure to all three areas, you can mix and match electives as your interests dictate. This is in fact what most students do and ensures maximum flexibility to work in a number of industries.

Degree Planning & Degree Navigator

Table 1, below is the program curriculum for 2017/18 (as outlined in the UBC Calendar). Where possible, we have tried to avoid course conflicts, particularly with core courses. However, as our program contains courses from many departments, it is impossible to ensure that all elective courses will fit into your schedule. We therefore encourage you to look at 3rd and 4th year courses together, and plan your electives far in advance so that you acquire the proper prerequisites for the electives you are most interested in. You may also find it easier to take a fourth year course in third year so that you can fit a technical elective into your timetable in fourth year.

Remember: *It is your responsibility to check that your program can be completed according to your preferred time for graduation. It is also your responsibility to check that your courses will fit together into a credible time table and that you will have the required pre-requisites for courses that you want to take in the future.*

Hint #1: Make a few photocopies and highlight courses you wish to take, according to the curriculum table. Then look at the course schedules. You will see right away whether they fit together. Then, check that all your pre-requisites are OK.

Hint #2: Make sure to check out **Degree Navigator**. Degree Navigator is an interactive advising tool designed to help you make informed decisions regarding your academic program. It will show the courses you have taken and the courses and degree requirements you still need to take.

Technical Electives

There are two types of technical electives: i) **constrained electives** where you must choose a course from a set list of courses, and ii) **unconstrained technical electives** where you are free to choose any approved course that's related to Geological Engineering (in the broadest sense). Most of the electives in the Geological Engineering program are unconstrained to give you maximum flexibility to tailor your program towards your interests. In the case of your "Earth Sciences Technical Elective" in third year, you are free to choose any 300/400 level science course offered in the Department of Earth, Ocean and Atmospheric Sciences; EOSC courses offered to Art's students might not be eligible.

In Table 2, you will find a list of some of the courses that have been pre-approved as unconstrained technical electives. Note also that courses in the lists of constrained technical electives may also be used to satisfy an unconstrained technical elective requirement. For example, in 3rd year you have the following constrained elective:

Select one of: EOSC 328 (Field Geology) (3)
EOSC 428 (Field Techniques in Groundwater Hydrology) (3)

You may select EOSC 328 to satisfy this constrained elective and then choose EOSC 428 to satisfy an unconstrained technical elective (or alternatively, your 300/400 level Earth Sciences Technical Elective).

Complementary Studies

Complementary Studies are a special set of unconstrained electives that are required for all Applied Science students. A set of minimum requirements are identified related to “Professional Development”, “Communications”, “Impact of Technology on Society”, “Engineering Economics” and “Humanities and Social Sciences”. These are described at the end of this document in Table 3, although students are also referred to the Engineering Student Services website: <http://students.engineering.ubc.ca/enrolment/degree-requirements/>

Engineering Design Project

All students entering fourth year will be required to take EOSC 445 Engineering Design Project. This two-term course is our capstone design experience and will involve team work, design, analysis, and communication (presentation and report writing). EOSC 445 complements three other design-focused courses specific to Geological Engineering: EOSC 433 *Geotechnical Engineering Practice*, EOSC 434 *Geological Engineering in Soils and Weak Rocks* and EOSC 429 *Groundwater Contamination*. Because EOSC 445 is a 6 credit course that spans Term 1 and 2, and must be taken consecutively in the same school year, students should not plan a co-op work term or international exchange in their final year when they would be taking these courses.

Engineering Co-Op & International Exchange

Co-Op offers an excellent opportunity to gain some valuable practical experience. In most years, the job market for Geological Engineering is relatively strong. However, all engineering disciplines can experience difficulties in finding work placements when the B.C. or Canadian economy is down. Remember, Co-Op is not a job placement service. It has also been our experience that students receive better work experiences by going through Co-Op than seeking their own summer jobs. This is of course your choice. However, many of the companies that hire preferentially from our program state that they can give a student a richer work experience when it involves an 8-month Co-Op placement compared to a 4-month summer job.

The 3rd year program in Geological Engineering is designed to be especially flexible to facilitate Co-Op or International Exchange experiences. For Co-Op, students have the option of a 16-month continuous work period (divided between two different company placements), or a combination of shorter 8- and 4-month placements to meet the minimum Co-Op requirements.

Term 2 of 3rd year only has two core courses and the remaining courses are technical electives, which is ideally suited for International Exchange. Exchange works best when you use the courses taken at the host university to meet your unconstrained technical elective requirements.

Table 1. Geological Engineering Curriculum**2nd Year** (for students with 2nd year standing in 2017/18)

Code	Course Name	Credits
APSC 201	Technical Communication	3
CIVL 210	Soil Mechanics I	4
CIVL 215	Fluid Mechanics I	4
CIVL 230	Solid Mechanics I	4
CIVL 231	Solid Mechanics II	3
EOSC 210	Earth Science for Engineers	3
EOSC 213 ⁺	Computational Methods in Geological Engineering	3
EOSC 220	Introductory Mineralogy	3
EOSC 221	Introductory Petrology	3
EOSC 223*	Field Techniques	3
EOSC 240	Site Investigation	3
MATH 253	Multivariable Calculus	3
	Total Credits	39

⁺ This course was introduced in 2016/17 to replace MATH 255 and 257. Note that 4th year students are still required to complete MATH 255 and 257 unless they receive permission from the Director to replace these with EOSC 213.

* Includes one-week field school at the end of Term 2.

3rd Year (for students with 3rd year standing in 2017/18)

Code	Course Name	Credits
CIVL 311	Soil Mechanics II	4
CIVL 316	Hydrology and Open Channel Flow	4
EOSC 323	Structural Geology I	3
EOSC 329	Groundwater Hydrology	3
EOSC 330	Principles of Geomorphology	3
EOSC 350	Environmental, Geotechnical, and Exploration Geophysics I	3
MINE 303	Rock Mechanics Fundamentals	3
STAT 251	Elementary Statistics	3
<u>Select one of:</u>		
EOSC 328	Field Geology	3
EOSC 428	Field Techniques in Groundwater Hydrology	
<u>Earth Sciences Technical Elective:</u>		
	300/400 science course from EOAS	3
<u>Complementary Studies:</u>		
	Impact of Technology on Society	3
	Humanities	3
<u>Unconstrained Technical Electives:</u>		
	Any 300/400 courses relevant to Geological Engineering	3
	Total Credits	41

4th Year (for students with 4th year standing in 2017/18)

Code	Course Name	Credits
CIVL 402	Engineering Law and Contracts in Civil Engineering	3
CIVL 410	Foundation Engineering I	3
CIVL 411	Foundation Engineering II	3
EOSC 350 ⁺⁺	Environmental, Geotechnical, and Exploration Geophysics I	3
EOSC 429	Groundwater Contamination	3
EOSC 433	Geological Engineering Practice I - Rock Engineering	3
EOSC 434	Geological Engineering Practice II - Soil Engineering	3
EOSC 445	Engineering Design Project	6
<u>Select one of (<i>Engineering Economics</i>):</u>		
	CIVL 403, MECH 431, MINE 396, MTRL 455, CHBE 459 EECE 450	3
<u>Unconstrained Technical Electives:</u>		
	Any 300/400 course relevant to Geological Engineering	12
Total Credits		42

** This course has been moved to 3rd year. However, 4th year students who have not yet taken EOSC 350 should complete this in 4th year.

Table 2. List of Pre-Approved Technical Electives

Note: The courses listed here are “*pre-approved*” in the sense of counting towards the technical elective requirements in Geological Engineering. Approval to register for these classes is at the discretion of the host department who may need to limit numbers due to classroom size. It is also your responsibility to check that you have the necessary pre-requisites for the courses listed here. In some cases, professors may be willing to waive the pre-requisites, but you will need to check with them or through their department to make this request. Also note that not all classes are taught every year. Please consult the [UBC Calendar](#) to confirm which classes are being offered in the current year.

S = Summer Term 1, 2

W = Winter Term 1, 2

APSC	461	Global Engineering Leadership	S 1
CIVL	304	Fundamentals of Environmental Engineering	W 2
	305	Introduction to Environmental Engineering	W 2
	315	Fluid Mechanics II (<i>4 credits</i>)	W 1
	320	Civil Engineering Materials	W 1
	406	Water Treatment and Waste Management	W 1
	407	Environmental Laboratory Analysis	W 1
	408	Geo-Environmental Engineering	W 2
	413	Design of Earth Dams and Containment Structures	W 2
	415	Water Resource Engineering	W 2
	416	Environmental Hydraulics	W 1
	417	Coastal Engineering	W 2
	418	Engineering Hydrology	W 1
EOSC	320	Sedimentology	W 2
	321	Igneous Petrology	W 1
	322	Metamorphic Petrology	W 2
	331	Introduction to Mineral Deposits	W 1
	332	Tectonic Evolution of North America	W 2
	340	Global Climate Change	W ½
	352	Geophysical Continuum Dynamics	W 2
	353	Seismology	W 2
	354	Analysis of Time Series and Inverse Theory for Earth Scientists	W 1
	420	Volcanology	W 1
	421	Advanced Sedimentology	W 2

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	422	Structural Geology II	W 2
	424	Advanced Mineral Deposits	W 2
	430	Aqueous Geochemistry	W 1
	431	Groundwater Remediation	W 2
	442	Climate Measurement and Analysis (<i>1 credit</i>)	W 1/2
	454	Applied Geophysics	W 2
FOPR	388	Analytical Methods in Forest Hydrology	W 1
FRST	385	Watershed Hydrology	W 1
	443	Remote Sensing for Ecosystem Management	W 1/2
GEOB	308	Quaternary and Applied Geomorphology	W 2
	370	Advanced Geographic Information Science	W 1
	373	Introductory Remote Sensing	W 2
	405	Fluvial Geomorphology	W 1
	406	Watershed Geomorphology	W 1
	408	Snow and Ice processes	W 2
GEOG	310	Environment and Sustainability	W 1/2
	312	Climate Change: Science and Society	W 2
	316	Geography of Natural Hazards	W 2
	319	Environmental Impact Assessment	W 1
	412	Water Management: Theory, Policy, and Practice	W 1/2
	497	The Arctic	W 2
IGEN	450	Pipeline Engineering	W 1
	451	Pipeline Systems and Infrastructure	W 2
MINE	302	Underground Mining and Design	W 2
	304	Rock Fragmentation	W 2
	310	Surface Mining and Design	W 1
	331	Physical Mineral Processes	W 1
	395	Mineral Deposit Modeling	W 1
	403	Rock Mechanics Design	W 1
	455	Mine Water Management	W 2
	480	Mine Waste Management	W 2
	485	Cave Mining Systems: Design and Planning	W 2
	486	Mining and the Environment	W 2
488	Heavy Oil Sand Mining and Processing	W 2	

Table 3. Complementary Studies

Students must take complementary studies courses totaling at least 20 credits. The minimum requirements are as follows:

Professional Development	2 credits	CIVL 402 (2)	Core in 4 th year Geological Engineering.
English (Communication)	6 credits	ENGL 112 (3) or APSC 176 (3)	Taken in 1 st year Applied Science.
		APSC 201 (3)	Core in 2 nd year Geological Engineering.
Engineering Economics	3 credits	CHBE 459 CIVL 403 CPEN 481 ELEC 481 MECH 431 MINE 396 MTRL 455	Choose one of. Usually taken in 3 rd or 4 th year Geological Engineering.
Impact of Technology on Society	3 credits	APSC 261, APSC 262, APSC 263, APSC 377, APSC 462, CIVL 200, CONS 210, CPSC 430, ECON 339, ECON 374, ENVR 410, FRST 415, GEOG 122, GEOG 250, GEOG 310, GEOG 352, HIST 106, HIST 215, HIST 260, HIST 396, HIST 425, PHIL 260, PHIL 435, POLI 361, SCIE 220, SOCI 260, SOCI 342, URST 200	Choose one of the following acceptable courses. Students may also seek approval from Engineering Student Services for other courses in this area. Generally taken in 3 rd year Geological Engineering.
Humanities and Social Sciences	6 credits	6 credits from the Faculty of Arts, focusing on the study of people, culture and social issues	Most courses from the Faculty of Arts are acceptable, including up to 3 credits of language courses. Generally, 3 credits are taken in 1 st year and 3 credits in 3 rd year Geological Engineering.

Additional details regarding Complementary Studies and eligible courses can be found on the Engineering Student Services website: <http://students.engineering.ubc.ca/enrolment/degree-requirements/>.