STUDENT GUIDE
GEOLOGICAL ENGINEERING
University of British Columbia
2018-2019

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 However, as our program evolves, curriculum changes will be made and this guide may become outdated.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 2018 - 2019 Geological Engineering entry in the UBC Calendar.

Our program is structured to include a set of core course requirements that all students must fulfill to graduate. In addition, there are a number of electives that allow you to 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 the Geological Engineering 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. Engineers and Geoscientists BC).

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. Tip: When using Degree Navigator, choose “Audit – UBC Report” as the view to visualize your degree in. Remember, Degree Navigator is a tool and not the official record of whether you have fulfilled your degree requirements.

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

For course registration, please contact the host department the course is being offered in. For those courses most common to the Geological Engineering program, this would be:

EOSC courses: Please contact our Undergraduate Programs Assistant, the kind and most helpful **Alicia Warkentin** (awarkentin@eoas.ubc.ca, 604-822-3146, ESB 2020).

Civil courses: Please complete their online course request form, which can be accessed via:

http://www.civil.ubc.ca/academic-programs/undergraduate-program/undergraduate-administrative-forms

Note that Civil will not process requests for Technical Electives until they have finished registering those requests involving core/required courses. This might not be until one or two weeks before the start of term. Further information can be found on their FAQ:

http://www.civil.ubc.ca/academic-programs/undergraduate-program/undergraduate-academic-program-faq#registration.

Mining courses: Please contact the Mining main office: http://mining.ubc.ca/_contact/ (e-mail: info@mining.ubc.ca).

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 2018/19, you must complete the 3rd year program as it appears in the 2018/19 calendar. If you received 3rd year standing in 2017/18 but are completing part of 3rd year in 2018/19 due to Co-Op or Exchange, you must complete your 3rd year program as it appeared in the 2017/18 calendar.

Your Degree Navigator should be programmed for this and is a useful tool to help you track which courses you need to complete. However, errors do occur in Degree Navigator and the UBC Calendar is the official record of what needs to be completed (UBC maintains an archive of past calendars). 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 Program 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. Note that if you need to take a field school at the end of your 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 in your Degree Navigator. These are produced below for 2018/19 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 technical 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 (note that pre-approval does not mean you are guaranteed a spot in one of the listed courses; registration is subject to the course not being full or that you meet any prerequisites). The list provided is not comprehensive and there may be new courses or other 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 field mapping skills (e.g., EOSC 328 instead of EOSC 428), and specifics regarding geotechnical practice in different industrial settings (e.g., block cave mining via MINE 485). You will gain skills relevant to the design of foundations, tunnels, open pit 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 area of interest 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 2018/19 (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. If you have any questions, please contact the Program Director to arrange a meeting.*

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 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).

Note 1: Technical electives MUST be 300 or 400 level courses. 100 and 200 level courses are not eligible as technical electives.

Note 2: The course level of the technical electives DO NOT have to match your standing. 300 level technical electives do not need to be taken in 3rd year, and similarly, 400 level technical electives do not need to be taken in 4th year. You may take any approved 300 or 400 level technical elective to meet your 3rd year technical elective requirements, and you may take any approved 300 or 400 level technical to meet your 4th year technical elective requirements.

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 with fourth year standing 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: EOSC 433 *Geological Engineering Practice I Rock Engineering;* EOSC 434 *Geological Engineering Practice II Soil Engineering;* and EOSC 429 *Groundwater Contamination*.

Because EOSC 445 is a 6 credit course that spans both Term 1 and 2, it 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 this course.

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 of the Geological Engineering Program 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.

Geological Engineering Program – Tables

Table 1 that follows outlines the Geological Engineering Program as it appears in the 2018/19 UBC Calendar. However, as previously noted, students must complete each year in their program as it appears in the UBC Calendar in the year they receive standing for that year. For example, if you received 3rd year standing in 2018/19, you must complete the 3rd year program as it appears in the 2018/19 calendar. If you received 3rd year standing in 2017/18 but are completing part of 3rd year in 2018/19 due to Co-Op or Exchange, you must complete your 3rd year program as it appeared in the 2017/18 calendar. Please consult your Degree Navigator for the correct list of courses you should register in if you have any questions regarding this.

If your Degree Navigator does not look correct, or if you have any questions, please contact the Geological Engineering Program Director: Prof. Erik Eberhardt (erik@eoas.ubc.ca, 604-827-5573, EOS-South 251).

Table 1. Geological Engineering Curriculum

2nd Year (for students with 2nd year standing in 2018/19)

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	4
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
STAT 251	Elementary Statistics	3
	Total Credits	***39***

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

3rd Year (for students with 3rd year standing in 2018/19)

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 (Add note about it moving to 2nd year)	3
Select one of:		
EOSC 328	Field Geology	3
EOSC 428	Field Techniques in Groundwater Hydrology	
Earth Sciences Technical Elective:		
	300/400 science course from EOAS	3
Complementary Studies:		
	Impact of Technology on Society	3
	Humanities	3
Unconstrained Technical Electives:		
	Any 300/400 courses relevant to Geological Engineering	3
	Total Credits	***41***

+ STAT 251 has been moved to the 2nd year program starting in 2018/19. However, it appears here in the 3rd year program for this year only for those students entering 3rd year in 2018/19 who still require it.

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

Code	Course Name	Credits
CIVL 402	Professionalism and Law in Civil Engineering	3
CIVL 410	Foundation Engineering I	3
CIVL 411	Foundation Engineering II	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
Select one of (*Engineering Economics*):		
	CIVL 403, MECH 431, MINE 396, MTRL 455, CHBE 459 ELEC 481, CPEN 481	3
Unconstrained Technical Electives:		
	Any 300/400 course relevant to Geological Engineering	12
	Total Credits	***39***

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
	462	Global Engineering Leadership Practicum	S 2
CIVL	305	Introduction to Environmental Engineering	W 2
	315	Fluid Mechanics II (*4 credits*)	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	W2
	340	Global Climate Change	W 1or2
	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

	422	Structural Geology II	W 2
	424	Advanced Mineral Deposits	W 2
	430	Aqueous Geochemistry	W 1
	431	Groundwater Remediation	W 2
	432	Fossil Fuels	W 2
	442	Climate Measurement and Analysis (*1 credit*)	W 1 or 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 2
GEOB	305	Introduction to Hydrology	W 2
	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 or 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 or 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
	420	Applied Geostatistics	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 (3)	Core in 4th year Geological Engineering.
English (Communication)	6 credits	ENGL 112 (3) or equivalent	Core in 1st year Applied Science.
		APSC 201 (3)	Core in 2nd 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 3rd or 4th year Geological Engineering.
Impact of Technology on Society, Sustainability, and Environmental Stewardship	3 credits	APSC 261 APSC 262 APSC 377 APSC 462 CIVL 200/CIVL 250 ENDS 221 MECH 410T MECH 410U PLAN 211 PLAN 341	Choose one of the following pre-approved courses. Students may also seek approval from the Geological Engineering Program Director for other courses covering these topic areas (i.e., impacts of technology, sustainability, and environmental stewardship). Generally taken in 3rd 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 1st year and 3 credits in 3rd 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/.