STUDENT GUIDE
GEOLOGICAL ENGINEERING
University of British Columbia
2022-2023

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 However, as our program evolves, curriculum changes will be made and this guide may become outdated.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, which can be accessed here through the link below:

2022 - 2023 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, but is under the jurisdiction of the Faculty of Applied Science with oversight provided by the Geological Engineering Board of Study. The undergraduate program leads to a BASc 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 “BASc in Geological Engineering” on their degree, and 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 British Columbia).

Getting Help

Degree Navigator

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 the view "Audit – UBC Report" to visualize your degree. Remember, Degree Navigator is a tool and not the official record of whether you have fulfilled your degree requirements. It is generally correct but might not be programmed for every option, for example, when it comes to acceptable technical electives. If you have any questions regarding your Degree Navigator, please contact the Director of Geological Engineering (see Advising).*

Course Registration – Standard Time Tables (STT)

Most students will register through a Standard Time Table (STT) that allows automatic registration in several core courses organized so that the times for lectures and labs are free of scheduling conflicts. This will only be possible if you haven't completed any of the courses listed in the STT. If you have completed one or more courses in the STT, for example during the previous school year, you will receive an error message. In this case, you will have to register for your courses individually (see next section).

Please note that not all core courses are included in the STT and students should make sure that there are not other required courses that they still need to register for separately. *For example, EOSC 213, MATH 253 and STAT 251 are all core to the 2nd year program but are not included in the STT.* Students must register for these separately. You can click here for the complete list of courses required for your year.

Also note that registering for a STT assumes that the student has all prerequisites for the courses listed in the STT. This means that it will allow students to register for courses they do not have the prerequisites for, and students might later be dropped from the course if they did not receive instructor approval to waive the prerequisites. Students should check this if they haven't completed all core courses from the previous year. If you have any questions regarding prerequisites, please contact the Director of Geological Engineering (see Advising). However, only the instructor for the course can grant a student request to waive a prerequisite.

Course Registration – Individual Courses/Non-STT

For students who need to register for non-STT courses, for example technical electives, or because they are not eligible for a STT, course registration must be carried out through the host department offering the course. The following are the procedures for the courses most common to the Geological Engineering program:

EOSC courses:	Please contact our Senior Program Assistant, the kind and most helpful **Ian Ayeras** (iayeras@eoas.ubc.ca, 604-822-3146, ESB 2020).
CIVL courses:	Please complete the Civil Engineering online course request form: https://www.civil.ubc.ca/webform/course-request-registration-form Note that Civil generally does not process requests for Technical Electives until they have finished registering those 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 (click here).

MINE courses:	Please contact the Mining main office: https://mining.ubc.ca/contact/
Complementary Studies courses:	These are a special category of courses that are Canadian Engineering Accreditation Board requirements that are common to all engineering programs. They include the "Humanities and Social Sciences Electives" and the "Impact of Engineering on Society, Sustainability and Environmental Stewardship" elective. Requests for course eligibility that differ from those provided on the Engineering Academic Services website (click here) should be directed to Engineering Academic Services.
First Year requirements courses:	The 1st-year program falls under the jurisdiction of Engineering Academic Services. For any 1st-year courses that still need to be completed or are not appearing correctly in Degree Navigator, please contact Engineering Academic Services.

Advising:

For questions regarding the program, advising, or approval of courses and technical electives, please contact the **Director of Geological Engineering, Prof. Erik Eberhardt** (eeberhar@mail.ubc.ca). You can also drop by his office at: EOS-South 251.

For questions related to transfer credits, yet-to-be-completed first year requirements or program requirements listed as "complementary studies" electives, contact **Engineering Academic Services** in the lobby of the Kaiser Building (https://academicservices.engineering.ubc.ca/).

For questions related to Co-Op, Go Global, Coordinated International Exchange, etc., contact the respective offices for these.

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 in years where new requirements have been introduced. The rule is that you must complete the 2nd, 3rd or 4th year of 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 2022/23, you must complete the 3rd year program as it appears in the 2022/23 calendar. If you received 3rd year standing in 2021/22 but are completing part of 3rd year in 2022/23 (for example due to Co-Op or Exchange), you must complete your 3rd year program as it appeared in the 2021/22 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 sometimes occur in Degree Navigator and the official record of what courses you need to complete is the UBC Calendar. Click here to access UBC's 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 Director of Geological Engineering (see Advising).

Note: The last major change to the Geological Engineering program was in 2018/19 when CIVL 231 was dropped from 2nd year and the credit load for 4th year was reduced from 42 to 39 credits. Students who entered the program in 2018 or later should not be affected by these changes. Students who entered the program before 2018 and still require CIVL 231 should contact the Geological Engineering Program Director

Field Schools and Time Tabling

There are two field-school course requirements 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. Please note that these courses may or may not require special fees separate from tuition that are charged to partially cover field costs. Information regarding any charges is usually provided in advance, but if you are working with a tight budget, you can check with our Senior Program Assistant, Ian Ayeras.

Note that if you need to take your third-year field school at the end of your fourth year right before graduating (more than half our students do), rest assured that your grades will be provided in time for spring convocation.

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 at the end of the Student Guide in Table 1 for 2022/23. 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 at the end of this document we have provided a list of pre-approved technical elective courses. Note that this pre-approval only applies to the course qualifying as an acceptable technical elective; ***course registration is at the discretion of the host department offering the course and is subject to the course not being full or that you meet any prerequisites***. To register for an elective you are unable to register for yourself, please see instructions above under Course Registration – Individual Courses/Non-STT. Note that some instructors are willing to waive prerequisites for students outside the department offering the course if the student has an equivalent course from their program of study. However, this is at the discretion of the instructor.

Also note that the list in Table 2 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 energy projects (site investigations, engineering design, project planning, construction, environmental protection, 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., dam construction via CIVL 413, mine waste management via MINE 380, etc.). You will gain skills relevant to the design of foundations, tunnels, hydroelectric dams, open pit and underground mines, natural hazard mitigation works, environmental protection works, 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. These jobs seek to balance the needs of society while working to ensure public safety and minimizing impacts on the environment.

Environmental interest:

An essential component of engineering design is recognizing and mitigating/minimizing the impacts that engineering projects can have on the natural environment. The technical electives you will want to consider for this specialization are similar to those for Geotechnical interest; the two are closely related and are equally important for careers in Geological Engineering. However, to specialize more you may want to consider 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). Your employment prospects will also be similar to those of your Geotechnical focused colleagues, including consulting and mining/energy companies who have specialized environmental groups.

Natural Resources interest:

This area of interest trains Professional Engineers for work in the mineral exploration or energy development industries. You will still obtain the same engineering skills to allow you to work in functions described under Geotechnical and Environmental interests, but you will focus more on geology and mineral deposits (e.g., EOSC 331, 424), geological mapping (e.g., EOSC 328 instead of EOSC 428), mining methods (e.g., MINE 485) and indigenous rights (MINE 470). 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 in two or all three areas, you can mix and match electives as your interests dictate.

Degree Planning & Degree Navigator

Table 1 below, is the program curriculum for 2022/23 (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 Geological Engineering Director to arrange a meeting.*

Hint #1: Make a list of courses you wish to take, and then check the course schedules. You will see right away where potential conflicts with lecture times and labs occur. Then, check that all your pre-requisites are okay.

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. Courses that are not eligible will state this in the calendar course description.

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 or year relative to the program requirements listed in the UBC Calendar. For example, the technical electives requirement listed under the 3rd year program do not need to be restricted to 300 level courses, and those listed under the 4th year program do not need to be restricted to 400 level courses. In both cases, you may take any approved 300/400 level technical to meet either the 3rd or 4th year technical electives 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". Students are referred to the Engineering Academic Services website for a listing of eligible courses to meet these requirement:

https://academicservices.engineering.ubc.ca/degree-planning/course-planning/

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.

Applied Science Co-Op

Co-Op offers an excellent opportunity to gain some valuable practical experience. Approximately 40% of Geological Engineering students take the Co-Op option. 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 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. Common schedules include:

Schedule A	FALL (Sept – Dec)	WINTER (Jan – April)	SUMMER (May – Aug)
YEAR 2	study	study	work-term 1
YEAR 3	work-term 2	work-term 3	work-term 4
YEAR 4	study	study	work-term 5
YEAR 5	study	study	graduation

Schedule B	FALL (Sept – Dec)	WINTER (Jan – April)	SUMMER (May – Aug)
YEAR 2	study	study	work-term 1
YEAR 3	study	study	work-term 2
YEAR 4	work-term 3	work-term 4	work-term 5
YEAR 5	study	study	graduation

Alternative 1	FALL (Sept – Dec)	WINTER (Jan – April)	SUMMER (May – Aug)
YEAR 2	study	study	work-term 1
YEAR 3	study	work-term 2	work-term 3
YEAR 4	work-term 4	study	work-term 5
YEAR 5	study	study	graduation

Alternative 2	FALL (Sept – Dec)	WINTER (Jan – April)	SUMMER (May – Aug)
YEAR 2	study	study	work-term 1
YEAR 3	work-term 2	study	work-term 3
YEAR 4	study	work-term 4	work-term 5
YEAR 5	study	study	graduation

Geological Engineering students interested in Co-Op can find more information, including application requirements and procedures, through the Applied Science Co-Op website.

Coordinated International Experience and International Exchange

The 3rd year of the Geological Engineering Program is designed to be especially flexible to facilitate an international exchange experience. Options include doing so through the Applied Science Coordinated International Experience (CIE) or UBC's GoGlobal. Note that both work best when the courses you take at the host university target meeting your unconstrained technical elective requirements.

Table 1. Geological Engineering Curriculum

The Geological Engineering Program for each year as they appear in the 2022/23 UBC Calendar:

2nd Year

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

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	4
Select one of:		
EOSC 328*	Field Geology	3
EOSC 428*	Field Techniques in Groundwater Hydrology	
Earth Sciences Technical Elective:		
	300/400 EOSC course from EOAS	3
Complementary Studies:		
	Impact of Engineering on Society, Sustainability and Environment	3
	Humanities	3
Unconstrained Technical Electives:		
	Any 300/400 courses relevant to Geological Engineering	6
	Total Credits	***42***

* Taught at the end of Term 2 after final exams.

4th Year

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, MINE 396, CHBE 459, MECH 431, MTRL 455, 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*" with respect to qualifying as being eligible to be counted 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, instructors 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	402	Living Language: Science and Society	W 1
	461	Global Engineering Leadership	S 1
	462	Global Engineering Leadership Practicum	S 2
ATSC	313	Renewable Energy Meteorology	W 2
CIVL	305	Introduction to Environmental Engineering Applications	W 2
	315	Fluid Mechanics II (*4 credits*)	W 1
	320	Civil Engineering Materials	W 1
	340	Transportation Engineering I	W 2

	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 1
	418	Engineering Hydrology	W 1
	475	Environmental Stewardship in Civil Engineering	W 1
CONS	330	Conservation Science and Sustainability	W 2
	425	Sustainable Energy: Policy and Governance	W 2
	440	Conservation Decision-Making and Policy	W 1
	481	Conservation Planning in Practice	W 1
CPSC	330	Applied Machine Learning	W1 or W2
	340	Machine Learning and Data Mining	W1 or W2
	440	Advanced Machine Learning	W 2
DSCI	320	Visualization for Data Science	W 2
ENVR	410	Energy, Environment, and Society	W 2
	430	Ecological Dimensions of Sustainability	W 1
	440	Analytical Methods in Sustainability Science	W 2
EOSC	320	Sedimentology	W 2
	321	Igneous Petrology	W 1
	322	Metamorphic Petrology	W 2
	326	Earth and Life Through Time	W1 or S1
	331	Introduction to Mineral Deposits	W 1
	332	Tectonic Evolution of North America	W 2
	340	Global Climate Change	W1 or W2
	352	Geophysical Continuum Dynamics	W 2
	353	Seismology	W 2
	410	Geoscientific Data Analysis and Empirical Modelling	W 1
	420	Volcanology	W 1
	421	Advanced Sedimentology	W 1
	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 (*1 credit*)	W1 or W2

	454	Applied Geophysics	W 2
FRST	385	Watershed Hydrology	W 1
	443	Remote Sensing for Ecosystem Management	W 2
GEOG	310	Environment and Sustainability	W1 W2 S1
	312	Climate Change: Science and Society	W 2
	314	Analysing Environmental Problems	W 2
	316	Geography of Natural Hazards	W 1
	318	Sustainability in a Changing Environment	W2 or S1
	319	Environmental Impact Assessment	W 1
	410	Environment and Society	W1 W2 S2
	412	Water Management: Theory, Policy, and Practice	W1 or W2
	497	The Arctic	W 1
GEOS	305	Introduction to Hydrology	W 2
	308	Quaternary and Applied Geomorphology	W 1
	309	Geographical Sciences Field Course	W 2
	370	Advanced Geographic Information Science	W1 or W2
	373	Introductory Remote Sensing	W 2
	405	Fluvial Geomorphology	W 2
	406	Watershed Geomorphology	W 1
	408	The Changing Cryosphere	W 2
IGEN	450	Pipeline Engineering	W 1
	451	Pipeline Systems and Infrastructure	W 2
MINE	302	Underground Mining and Design *(4 credits)*	W 2
	304	Rock Fragmentation	W 2
	310	Surface Mining and Design *(4 credits)*	W 1
	380	Mine Waste Management	W 2
	395	Mineral Deposit Modeling	W 1
	403	Rock Mechanics Design	W 2
	406	Mine Project Valuation and Risk Assessment	W 2
	420	Applied Geostatistics	W 2
	455	Mine Water Management	W 2
	470	Indigenous Peoples and Mining in Canada	W 1
	485	Cave Mining Systems: Design and Planning	W 2
	486	Mining and the Environment	W 2