




CIVIL HANDBOOK

 2020-21



University of Manitoba
Engineering Society



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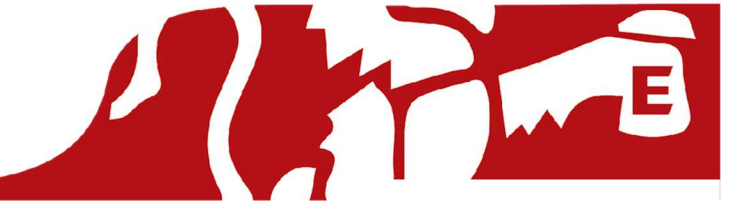
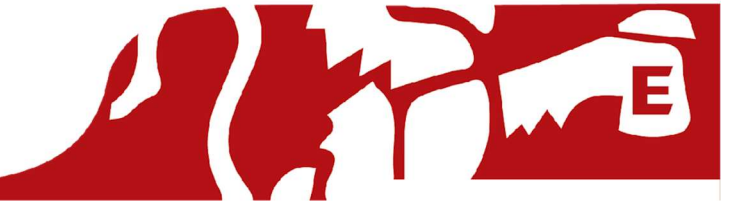


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Civil Engineering

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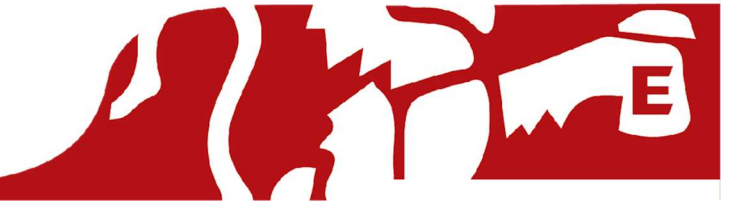
Department Description

Civil Engineering work addresses issues related to infrastructure and to the environment. More specifically, civil engineers design, manage, maintain, and supervise the implementation of various structures using advanced technologies and computer-aided engineering. Civil engineers serve as key players in areas such as urban redevelopment, meeting the challenges of sustainable development, environmental pollution control, public infrastructure renewal, and the preparation for, or recovery from, natural disasters.

In addition to the standard Civil Engineering program, the department offers an Environmental Option for students interested in this field. Students interested in this program should consult with the Civil Department Office to select an appropriate set of elective courses.

Options

The Environmental Engineering Option provides an opportunity for students to focus on environmental engineering related courses. For other areas of study, students can choose their design and elective courses to be focused on a specific topic, but they are not formal specializations designated on transcripts.



Tips for Incoming Civil Students

These tips are from current civil students and students from other departments.

1. If they are available, old midterms and finals are one of the best ways to prepare for your exams. Pay attention to the style of questions your professor has given in the past and to the concepts that were emphasized in previous years' exams.
2. Make friends, you will have several group projects for which you get to choose your partners.
3. Don't leave all of your tech electives for your last year, they conflict with each other and you will not be able to get into the courses you want.
4. Consider taking your complementary electives in the evenings during the summer. They are less demanding, and you can lighten your course load during the school year.
5. Many of your courses will have weekly quizzes or assignments. Even though they aren't worth a large percentage of your grade, put in as much effort as you can. Your marks in these sections of the course can help boost your overall grade.
6. Take advantage of the professors' office hours, they can provide assistance on assignments and with studying for tests and exams.
7. Get your card encoded at the earliest opportunity, there are usually a few days it is done every fall term; it will be needed to access rooms such as the CAD lab.



Course List

For 4- and 5-year course schedules, stream information and other helpful spreadsheets, visit:

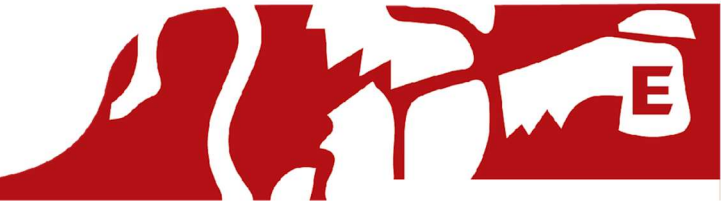
http://umanitoba.ca/faculties/engineering/departments/civil/curr_students/undergrad/programreq_timetable.html

Second Year Courses

Applied Chemistry for Engineers	(CHEM 1310)	3CR
Engineering Communication	(ENG 2030 or ENG 2040)	3CR
Engineering Mathematical Analysis 1	(MATH 2130)	3CR
Engineering Mathematical Analysis 2	(MATH 2132)	3CR
Geology for Engineers	(GEOL 2250)	4CR
Contemporary Statics for Engineers	(STAT 2220)	3CR
Civil Engineering Materials	(CIVL 2770)	5CR
Civil Engineering Systems	(CIVL 2780)	4CR
Fluid Mechanics	(CIVL 2790)	4CR
Solid Mechanics	(CIVL 2800)	4CR
Graphics for Civil Engineers	(CIVL 2830)	2CR
Civil Engineering Geomatics	(CIVL 2840)	3CR

Third Year Courses

Environmental Ethics*	(PHIL 2750)	3CR
<i>*or a complementary elective</i>		
Engineering Economics	(ENG 3000)	3CR



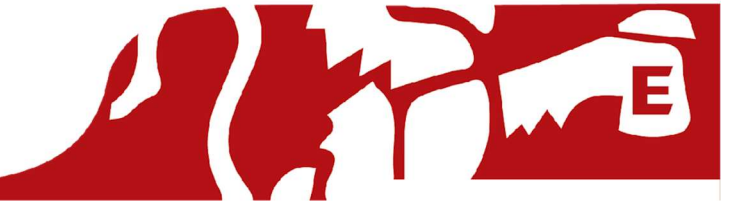
Numerical Methods	(CIVL 3590)	4CR
Environmental Engineering Analysis	(CIVL 3690)	4CR
Environmental Engineering Design	(CIVL 3700)	4CR
Geotechnical Materials and Analysis	(CIVL 3730)	4CR
Hydraulics	(CIVL 3740)	4CR
Hydrology	(CIVL 3750)	4CR
Structural Analysis	(CIVL 3760)	4CR
Structural Design 1	(CIVL 3770)	4CR
Transportation Engineering 1	(CIVL 3790)	4CR

Fourth Year Courses

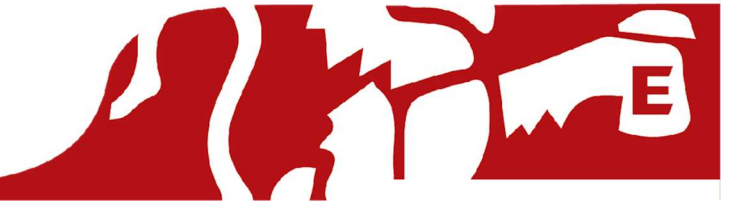
Geotechnical Design	(CIVL 4220)	4CR
Infrastructure Engineering and Construction Management	(CIVL 4380)	4CR
Structural Design 2	(CIVL 4390)	4CR
Transportation Engineering 2	(CIVL 4400)	4CR
Design Project	(CIVL 4590)	6CR
Technology, Society, and the Future	(CIVL 4460)	3CR

Technical Electives

Finite Element Analysis	(CIVL 3710)	4CR
Masonry Design	(CIVL 4020)	4CR
Design of Concrete Mix	(CIVL 4022)	4CR



Sustainable Building Design	(CIVL 4024)	4CR
Advanced Structural Design	(CIVL 4030)	4CR
Structural Dynamics	(CIVL 4040)	4CR
Engineering Management and Environment	(CIVL 4100)	4CR
Water Treatment Plant Design	(CIVL 4120)	4CR
Solid Waste	(CIVL 4130)	4CR
Environmental Systems	(CIVL 4180)	4CR
Groundwater Contamination	(CIVL 4200)	4CR
Geotechnical Engineering	(CIVL 4230)	4CR
Geotechnical Earthquake Engineering	(CIVL 4232)	4CR
Groundwater Hydrology	(CIVL 4250)	4CR
Design of Urban Water Systems	(CIVL 4300)	4CR
Thesis Project	(CIVL 4332)	4CR
Hazardous Waste	(CIVL 4350)	4CR
Water Resources Planning and Management	(CIVL 4360)	4CR
Transportation Systems	(CIVL 4410)	4CR
Highway Pavement Design	(CIVL 4420)	4CR
Air Pollution	(BIOE 4460)	4CR
Watershed Processes	(CIVL 4470)	4CR
Remediation of Contaminated Soil	(SOIL 4500)	3CR
Structural Design in Wood	(BIOE 4560)	4CR



Course Descriptions

SECOND YEAR CORE COURSES DESCRIPTIONS

Introduction to Physical Chemistry (CHEM 1310) 3CR

Thermochemistry, chemical thermodynamics, and chemical kinetics. This course expands on topics covered in high school chemistry that were not included in CHEM 1300. This course is more math intensive than CHEM 1300, which some people have difficulty with. CHEM 1300 is a prerequisite.

Difficulty: 3 **Workload:** 3.5

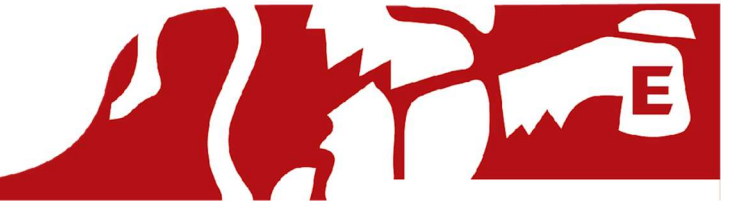
Tips: Start your lab write ups early so that you have time to ask questions if needed and also to consult with other peers.

Engineering Communication (ENG 2030 or ENG 2040) 3CR

Take only one of ENG 2030: Students work in a team-based environment to produce deliverables comparable to the engineering workplace. In-class tutorials focus on the sharpening of individual students' writing skills through an analytical, problem-solving and critical thinking approach. Students are exposed to a variety of communicative scenarios and emphasis is placed on development of a repertoire of skills necessary for effective communication in the engineering profession. OR ENG 2040: This team-based course focuses on a rhetorical approach, communication strategies and guided practice in the design of engineering communications. ENGL 1400/1310, ENG 1430 (or former ENG 2010) prerequisite.

Difficulty: 3 **Workload:** 5

Tips: Make sure to get started on your final report early to allow lots of time for editing. Wear business clothes for all presentations. Try to keep up with entries in your journal.



Math Analysis 1 (MATH 2130) 3CR

Multivariable differential and integral calculus up to and including multiple integrals in cylindrical and spherical coordinates. For Engineering and Geophysics students only. Have fun with derivatives and integrals in 3D. MATH 1710 and MATH 1210 are prerequisites.

Difficulty: 3.5 **Workload:** 3

Tips: Make sure to review your notes from Calculus 2 before starting this class. The textbook has lots of practice problems, which are a great way to prepare for the tests. Make an effort to attend the tutorials, as the professors will go through practice problems.

Math Analysis 2 (MATH 2132) 3CR

Infinite series, Taylor and Maclaurin Series; ordinary differential equations including Laplace transforms. For Engineering and Geophysics students only. This class introduces many new concepts unlike Math 1, which mostly builds on first year Calculus. MATH 1210 and MATH 1710 are prerequisites. Note that Math 1 is not a prerequisite.

Difficulty: 4 **Workload:** 3

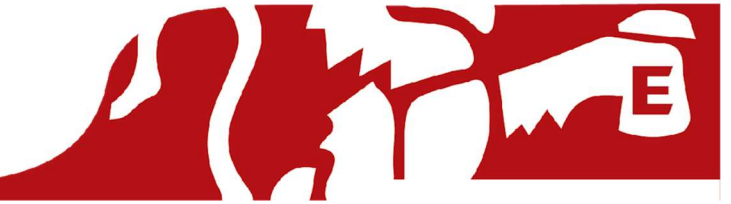
Tips: The best way to prepare for your midterms and final is to do lots of practice problems in the textbook. The tutorials are taught by the professor, so they are a great opportunity to go through additional practice problems and ask your questions.

Contemporary Statistics for Engineers (STAT 2220) 3CR

Descriptive statistics, basic probability concepts, special statistical distributions, statistical inference-estimation and hypothesis testing, regression, reliability, statistical process control. Up to the midterm this class is pretty easy. After the midterm it becomes more difficult and you start doing some derivatives, but with a bit of practice it's manageable. MATH 1710/1700 is a prerequisite.

Difficulty: 2 **Workload:** 2

Tips: Make sure you keep up with the practice problems. Although the material is relatively straightforward, it can get a little overwhelming if you fall behind. Also, don't forget to study theory questions in addition to your normal numerical question practice.



Geology for Engineers (GEOL 2250) 4CR

Principles of physical geology; materials in processes in geology; classification of igneous, metamorphic, and sedimentary rocks; elementary geological and geophysical surveying techniques; geological hazards, volcanism, earthquakes, land sliding, processes of weathering, transportation and geomorphology. The material in this course is straightforward but there is a lot of information to memorize. The huge amount of memorizing means you still have to study quite a bit to do well in this class. No prerequisites.

Difficulty: 2.5 **Workload:** 3

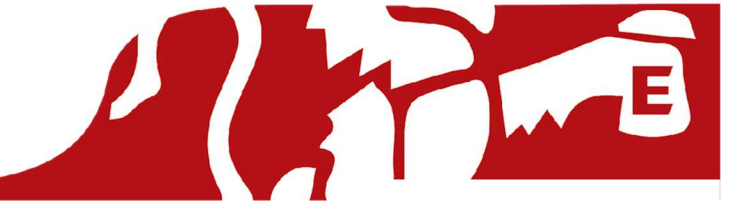
Tips: Not Available

Civil Engineering Materials (CIVL 2770) 5CR

Principles of testing; testing standards; instrumentation; data acquisition systems; mechanical properties of steel, iron, cement, concrete, asphalt, wood and composites; classification and particle size analysis of soils and aggregates. ENG 1440 and CIVL 2800 are prerequisites.

Difficulty: 4 **Workload:** 5

Tips: Make sure to bring a phone to the labs because the lab facilitator writes a lot of helpful information on the whiteboard which will be indispensable when writing the lab reports. It also helps if you bring a surface to write on to the lab (such as a clipboard), since most of your notes are written while standing.



Civil Engineering Systems (CIVL 2780) 4CR

Introduction to applied systems analysis approach. Use of applied systems analysis in Civil Engineering. Optimization techniques: linear programming; dynamic programming; other techniques. Evaluation: decision analysis. This course is all about solving optimization problems. Basically, you turn word problems into numerical problems and then solve them mathematically. Up to the midterm, you solve problems mostly by hand. After the midterm, you will mostly be using Microsoft Excel to solve problems. MATH 1710/1700 is a prerequisite.

Difficulty: 3 **Workload:** 3

Tips: Become familiar with the ins-and-outs of Excel early into the semester so your Excel abilities don't affect your learning later on.

Fluid Mechanics (CIVL 2790) 4CR

Definition of fluid; fluid properties; variation of pressure in a fluid; hydrostatic forces; buoyancy; kinematics of flow; control volumes; continuity; Bernoulli's equation; momentum equation; energy equation; flow in closed conduits; open channel flow. This course has tutorials, labs, assignments and quizzes. Be prepared to put lots of work into this class. ENG 1440 and MATH 1710 are prerequisites.

Difficulty: 3 **Workload:** 3.5

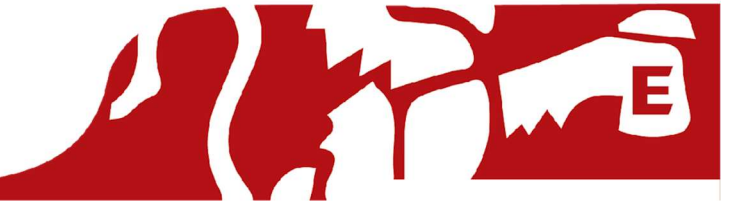
Tips: Not Available

Solid Mechanics (CIVL 2800) 4CR

Analysis of deformable bodies; stress and strain in three dimensions; equilibrium equations and strain-displacement relations; constitutive relations and mechanical behaviour of materials; radially symmetric and plane problems in elasticity; relevant experimental demonstrations. This course is kind of a like a more advanced Statics course and it contains lots of math and equations. MATH 1710/1700 and ENG 1440 are prerequisites.

Difficulty: 3.5 **Workload:** 3.5

Tips: Not Available



Graphics for Civil Engineers (CIVL 2830) 2CR

Orthographic Drawing: Object Orientation and Views, Space Dimensions, Surfaces, Lines, and Hidden Features. Computer-based Drawings. Applications: Steel and Reinforced Concrete Structures, Digital Terrain Models. Ethical, Legal and Professional Issues. This course teaches Computer Aided Design (CAD) using the AutoCAD program. Be prepared to spend lots of time in the AutoCAD lab working on assignments. CIVL 2840 is corequisite.

Difficulty: 2.5 **Workload:** 3

Tips: Not Available

Civil Engineering Geomatics (CIVL 2840) 3CR

Geomatics in civil engineering, map-making, map-reading, computerized maps; leveling; distance measurement angles, directions, traverses; coordinate geometry; electronic survey instruments; global positioning system; geographic information systems; digital photogrammetric methods and data; aspects of route surveying. This course teaches some basic surveying skills and it's a must-have course if you want to get a Civil engineering co-op position. MATH 1210 and CIVL 2030 are corequisites.

Difficulty: 3 **Workload:** 2

Tips: Not Available

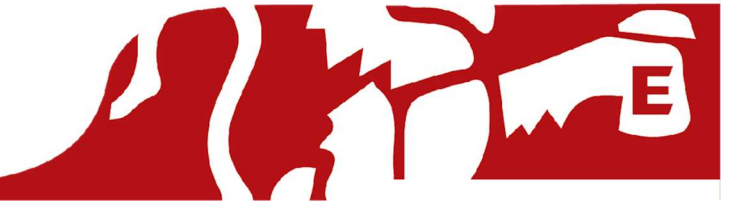
THIRD YEAR CORE COURSES DESCRIPTIONS

Environmental Ethics (PHIL 2750) 3CR [or a complementary elective]

An examination of some important ethical issues connected with environmental pollution and resource depletion. Examples to be covered include: the ideal of liberty and environmental limits; scarcity and the ideal of justice; growth vs. steady-state economics; animal rights, and survival ethics vs welfare ethics. Students may not hold credit for PHIL 2750 and any of: PHIL 2751 or PHIL 2290 or PHIL 2531. Prerequisite: successful completion of 30 hours of university credit.

Difficulty: 2 **Workload:** 2

Tips: Not Available



Engineering Economics (ENG 3000) 3CR

Introduction to engineering economics. Time value of money and discounted cash flow calculations. Comparing alternatives. Replacement analysis and life-cycle costing. Public sector engineering economy studies. Private sector engineering economy studies. Before and after-tax analysis. Applications in cost-estimating. Applications in asset management systems. Basic accounting. Accommodating capital limitations. Dealing with inflation. Dealing with risk and uncertainty. Statistics is a prerequisite for this course, but it really has nothing to do with what you learned in it. This course covers basic economic analysis that is applicable to engineers. for STAT 2220 is a prerequisite.

Difficulty: 3 **Workload:** 3

Tips: Practice makes perfect!

Numerical Methods (CIVL 3590) 4CR

Variety of numerical techniques applicable to solutions of problems in civil engineering. This course is essentially a cross between a math course and a computer science course. You will use MATLAB to solve mathematical problems. COMP 1012 is a prerequisite and MATH 2132 is a corequisite.

Difficulty: 3.5 **Workload:** 3

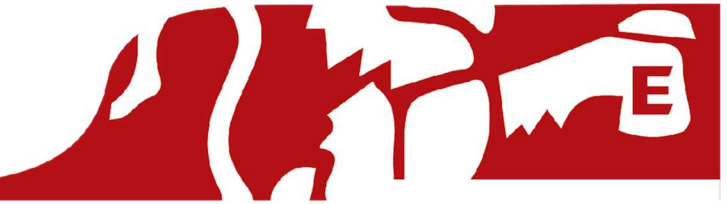
Tips: Not Available

Environmental Engineering Analysis (CIVL 3690) 4 CR

Introduction to environmental engineering analysis concept; risk assessment; colloidal dispersions; mass balances, reaction kinetics and reactor design principles. Water pollution and water quality in rivers and lakes. Physical, chemical and biological unit operations and processes applied in water and/or wastewater treatment. Meteorology and air pollution; atmospheric dispersion. Solid waste management issues. This class mostly focuses on treating drinking water to make to suitable for human consumption. Note that this class is involves a lot of chemistry and you will be using what you learned in CHEM 1310 quite a bit. CHEM 1310/2560 are prerequisites.

Difficulty: 3 **Workload:** 3

Tips: Not Available



Environmental Engineering Design (CIVL 3700) 4CR

Design principles are developed for water, solid/soil and air pollution control. Application of the principles in design projects which may include surface and groundwater remediation, solid waste management, landfilling, soil remediation and site assessment; municipal and industrial wastewater treatment; odour and air pollution abatement facilities. CIVL 3690 is a prerequisite.

Difficulty: 3 **Workload:** 3

Tips: Not Available

Geotechnical Materials Analysis (CIVL 3730) 4 CR

Geotechnical Materials and Analysis (3-1.5T:0-0) 4 Soil and rock properties: laboratory and field techniques; in situ states of stress and consolidations; constitutive models; stress beneath loaded areas and around tunnels; analysis of simple retaining structures and slopes; stability and settlement of shallow and deep foundations in soil and rock. CIVL 2800 and GEOL 2250 are prerequisites.

Difficulty: 4 **Workload:** 3

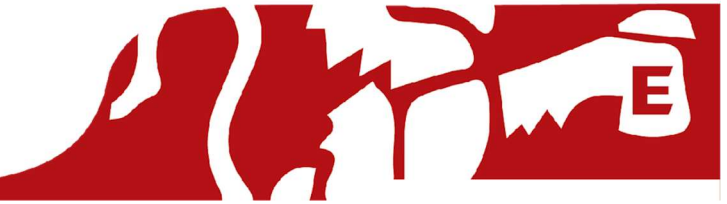
Tips: Not Available

Hydraulics (CIVL 3740) 4CR

Hydraulics of uniform and gradually varied flow; backwater computation and classification of surface water profiles; hydraulics jumps, spillways, and stilling basins; flow over weirs; hydraulic models; theory of turbo-machinery. This course is essentially Fluid Mechanics 2.0 and you will expand on some of the topics covered in Fluid Mechanics. CIVL 2790 is a prerequisite.

Difficulty: 3 **Workload:** 3

Tips: Review your Fluid Dynamics notes if it's been awhile since you've taken that class.



Hydrology (CIVL 3750) 4CR

Basic hydrological processes; precipitation; evapotranspiration; infiltration and runoff; analytical methods; hydrograph theory and application; application to reservoir design; project floods and flow forecasting; statistical analysis. This course covers a lot of content, but it mostly focuses on calculations involving flow in rivers. This course has tutorials, labs, assignments and quizzes. STAT 2220 is a corequisite.

Difficulty: 4 **Workload:** 4

Tips: Be prepared to put lots of work into this class.

Structural Analysis (CIVL 3760) 4CR

Different structural forms and load distribution, analysis of cables; statically determinate curved, beams and frames; influence lines; energy methods and deflections of structures; flexibility and stiffness methods; computer-aided structural analysis; introduction to structural dynamics. STAT 2220 is a pre- or corequisite.

Difficulty: 3.5 **Workload:** 4

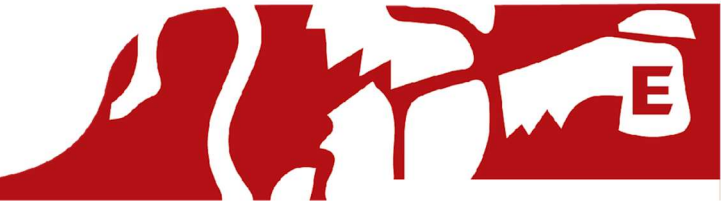
Tips: Practice some Solid Mechanics problems before the course starts to prepare yourself for the types of content that will be covered in this course.

Structural Design 1 (CIVL 3770) 4CR

Introduction to design of steel structures; loading, structural configurations; design of simple members and connections; building code requirements. CIVL 2770 and 3760 are prerequisites.

Difficulty: 4 **Workload:** 4

Tips: To solve problems in this class, you must be very systematic. There is a lot of looking up formulas and constants from the Handbook of Steel Construction.



Transportation Engineering 1 (CIVL 3790) 4CR

Introduction to transportation. Overview of Canada and U.S. transport systems. Fundamentals of transport systems analysis. Introduction to sequential demand modeling. Analysis and evaluation of uninterrupted flow on highways. Basics of geometric design of highways. Basics of design of at-grade intersections. Introduction to computer applications in transportation engineering. Basics of pavement engineering and design. CIVL 2770, 2780, 2840 STAT 2220 are prerequisites.

Difficulty: 2.5 **Workload:** 3.5

Tips: This course focuses mostly on car-centric transportation design. In general, it is more Math/Formula-based than Transportation Engineering 2.

FOURTH YEAR CORE COURSES DESCRIPTIONS

Geotechnical Design (CIVL 4220) 4CR

Site characterization; design and construction of surface footings, deep foundations, tunnels, earth and rock support systems; design and remediation of slopes; frozen soils and foundation design; geosynthetics and geofabrics in geotechnical construction; reinforced earth; geo-environmental issues; tailing dams, clean-up, and remediation. CIVL 3730 is a prerequisite.

Difficulty: Not Available **Workload:** Not Available

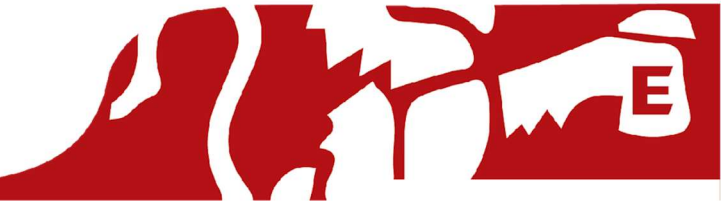
Tips: Not Available

Infrastructure Engineering and Construction Management (CIVL 4380) 4CR

Infrastructure engineering; drainage systems, maintenance engineering and management. Construction and project management; workplace health and safety, construction site field trips, construction equipment, temporary facilities, project management. Elements of law for civil engineers. CIVL 4050 is a prerequisite.

Difficulty: 3 **Workload:** 2

Tips: This course covers a lot of material, but none of the material is particularly difficult. Make sure you take good notes so you don't get overwhelmed with the amount of content.



Structural Design 2 (CIVL 4390) 4CR

Design in reinforced concrete; properties of materials; ultimate strength design; analysis and design of sections in bending; shear and development considerations; short- and long-term deflection; sections subjected to bending and axial stresses; design of simple floor systems; column footings. CIVL 2770, 2800, 3760, 3770 are prerequisites.

Difficulty: 4 **Workload:** 4

Tips: Not Available

Transportation Engineering 2 (CIVL 4400) 4CR

Fundamentals of traffic control for highways. Capacity and level of service analysis on urban streets. Transportation design for pedestrians and cyclists. Urban supplement to geometric design guide for Canadian roads. Modelling vehicle performance. Elements of railway engineering. Design for trucks. Transportation systems management. Application of intelligent transportation systems. Legislative and policy framework for transportation engineering. CIVL 3790 is a prerequisite.

Difficulty: 3 **Workload:** 3.5

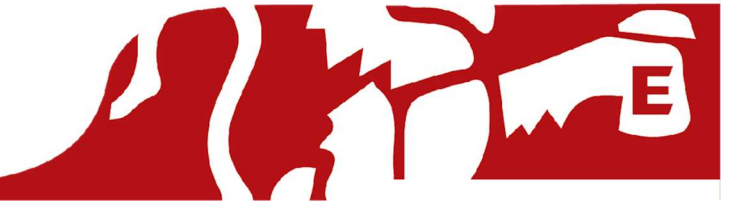
Tips: This course is less car-centric than Transportation Engineering 1. Be prepared to think like a pedestrian or cyclist.

Technology, Society, and the Future (CIVL 4460) 3CR

Impact of technology and technological change on society - past, present, future; specific technologies, e.g. construction, machine power, computers, communications, medical, military: the process of technological change; invisible effects of technology; technology and use; sustainable development, limits to growth and the role of technology. ENGL 1400/1310 is a prerequisite.

Difficulty: 2.5 **Workload:** 2.5

Tips: Legend says this course isn't that difficult.

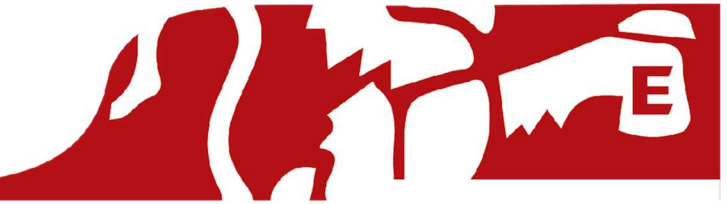


Design Project (CIVL 4590) 6CR

An interdisciplinary project-based course involving engineering design, teamwork and delivered in studio format. Students are expected to work in pre-assigned teams under the guidance of professional engineers on a pre-determined project. Lecture material will cover project management, construction, environmental and economic issues. Each team will be required to give an oral presentation of their design project. ENG 2010, CIVL 2840, 3700, 3740, 3750, 3770, 3790 are prerequisites.

Difficulty: 4 **Workload:** 5

Tips: Not Available



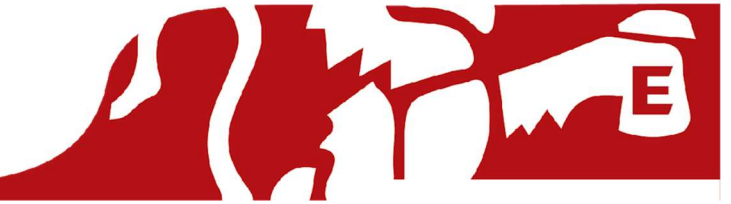
TECHNICAL ELECTIVE COURSES DESCRIPTIONS

The following technical elective are offered for the Fall 2020 term:

Finite Element Analysis	(CIVL 3710)	4CR
Groundwater Contamination	(CIVL 4200)	4CR
Design of Urban Water Systems	(CIVL 4300)	4CR
Highway Pavement Design	(CIVL 4420)	4CR
Thesis Project	(CIVL 4332)	4CR

The following technical elective are offered for the Winter 2021 term:

Water Treatment Plant Design	(CIVL 4120)	4CR
Environmental Systems	(CIVL 4180)	4CR
Geotechnical Earthquake Engineering	(CIVL 4232)	4CR
Water Resources Planning and Management	(CIVL 4360)	4CR
Thesis Project	(CIVL 4332)	4CR
Bridge Design	(CIVL 4500)	4CR
Sustainable Construction	(CIVL 4500)	4CR
Statistical Methods	(CIVL 4500)	4CR
Structural Design in Wood	(BIOE 4560)	4CR



Finite Element Analysis (CIVL 3710) 4CR

One-dimensional analysis of fluid flow, seepage and heat transfer; truss, beam and frame elements; two-dimensional problems; isoparametric elements and Gauss quadrature; time-dependent problems, diffusion, consolidation, and time integration methods; introduction to commercial packages; solution of problems in civil engineering (seepage, dams, pavements). CIVL 2790, 2800, 3590 are prerequisites.

Difficulty: 3.5 **Workload:** 3

Tips: Not Available

Masonry Design (CIVL 4020) 4CR

Introduction to the building codes that govern masonry design. Advanced design procedures for masonry members and structures. Single-story and multi-storey building design. CIVL 3760 is a prerequisite.

Difficulty: Not Available **Workload:** Not Available

Tips: Not Available

Design of Concrete Mix (CIVL 4022) 4CR

Constituent materials (cement, admixtures, etc.) of concrete; performance-based design and control of concrete mixtures; fresh, hardened and durability properties of concrete. At the end of the course, you will get to design your own concrete mixture with several teammates. CIVL 2770 is a prerequisite.

Difficulty: 3 **Workload:** 3.5

Tips: The final report is a lot of work, make sure you get started on it early.