



# CIVL HANDBOOK



2016-17



**University of Manitoba**  
Engineering Society



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# Civil Engineering

## Department Contacts

Department Head: Ahmed Shalaby ([ahmed.shalaby@umanitoba.ca](mailto:ahmed.shalaby@umanitoba.ca))

Associate Head: Peter Rasmussen ([peter.rasmussen@umanitoba.ca](mailto:peter.rasmussen@umanitoba.ca))

Associate Head Research: Dimos Polyzois ([dimos.polyzois@umanitoba.ca](mailto:dimos.polyzois@umanitoba.ca))

Undergraduate Advisor:

## 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.



## 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 complimentary 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.



## Conferences and Competitions

### **WESST Executive Meeting (WESST EM) - <http://em.wesst.ca>**

Participation Available To: *UMES Executives only*  
2015/2016 Conference Dates: *May 7<sup>th</sup> – 10<sup>th</sup>, 2015*  
2015/2016 Conference Location: *Edmonton, AB*

WESST EM brings together student representatives from 10 engineering schools in Western Canada. The conference includes a number of sessions, presentations, meetings and discussions centered around the development of student leadership skills.

### **WESST Retreat - <http://wesst.ca/retreat/>**

Participation Available To: *All Engineering students*  
2015/2016 Retreat Dates: *Early October*  
2015/2016 Retreat Location: *Regina, SK*

This retreat offers students from the 10 WESST schools an opportunity to interact in a camp setting. In addition to WESST's AGM, retreat activities include sessions on building leadership skills and a number of social and team-building activities.

### **Conference on Diversity in Engineering (CDE) - <http://2015.cde.cfes.ca/index.html>**

Participation Available To: *All Engineering students*  
2015/2016 Conference Dates: *November 13<sup>th</sup> – 15<sup>th</sup>, 2015*  
2015/2016 Conference Location: *Waterloo, ON*

This conference focuses on the importance of diversity in Engineering, specifically examining the role of students in achieving the industry's related goals. CDE attracts approximately 150 engineering students from across Canada.

### **University of Manitoba Engineering Competition (UMEC) - <http://umes.mb.ca/node/56>**

Participation Available To: *All Engineering students*  
2015/2016 Competition Dates: *End of November*  
2015/2016 Competition Location: *U of M Engineering*

This competition is run annually by UMES and is held here at the U of M. All students are encouraged to participate, and those who qualify will be sponsored by UMES to subsequently attend WEC (see below).



**CFES Congress - <http://congress.cfes.ca>**

Participation Available To: *All Engineering students*  
2015/2016 Conference Dates: *January 3<sup>rd</sup> – 9<sup>th</sup>, 2016*  
2015/2016 Conference Location: *Calgary, AB*

Congress is an annual, student-run conference hosted by a different CFES school each year. The conference serves not only as CFES' Annual General Meeting (AGM), but also as a platform for students to interact with both engineering students and professionals from across the country. Each year CFES Congress attracts 150 to 200 student delegates from over 40 Canadian engineering schools.

**Western Engineering Competition (WEC) - <http://wec2015.ca>**

Participation Available To: *Winners of UMEC*  
2015/2016 Competition Dates: *January 22<sup>nd</sup> – 26<sup>th</sup>, 2016*  
2015/2016 Competition Location: *Kelowna, BC*

Run annually by WESST, this competition provides students from 10 Western Canadian engineering schools the opportunity to engage in competition. The competition also includes a series of industry tours and networking activities. Those who place first or second in their category qualify for CEC.

**Canadian Engineering Competition (CEC) - <http://cec2016.com>**

Participation Available To: *Winners of WEC*  
2015/2016 Competition Dates: *March 3<sup>rd</sup> – 6<sup>th</sup>, 2016*  
2015/2016 Competition Location: *Montreal, QC*

This competition is run annually by CFES and brings together 150 of the most innovative and creative Canadian engineering undergraduate students. In addition to gaining competition experience, participants will have the opportunity to engage with engineering students and professionals from across the country.

**International Engineering Competition (IEC) - <http://cfes.ca/events-and-services/iec/>**

Participation Available To: *Winners of CEC*  
2015/2016 Competition Dates: *TBA*  
2015/2016 Competition Location: *TBA*

Also organized annually by CFES, the International Engineering Competition engages students from across Canada, the United States and Europe in consulting and design engineering challenges. Much like CEC, participants are also provided the opportunity to interact with a diverse group of engineering students and professionals.



## Summer Session and Minors

### Summer Sessions

Extended Education

188 Continued Education Complex  
summer@umanitoba.ca

474-8008

<http://umanitoba.ca/summer/>

Taking summer session courses is a good way to reduce your workload during the year. However, do not rely on taking a given course during the summer as the course offerings at this time are very irregular. Those courses offered during the summer are targeted primarily at students who couldn't fit a course into their regular session or who failed/dropped a course during the regular session. If interested, you may petition a faculty to make a course available during the summer. Contact the Vice Stick Academic for help with putting a petition together.

Some courses which are typically offered in the summer include the engineering math courses (Calc I & II, Linear Algebra, Math 1 & 2), some preliminary year engineering courses (such as Intro. to Thermal Sciences and Statics), CHEM 1300 and many Arts and Management courses suitable for your complementary electives. Note that the Summer Session calendar is released in March. The term is generally divided into Spring and Summer "terms" of 2 months each, with some courses spanning both terms.

### Minors

Engineering Student Affairs Office

EITC E1-284

Judy.Schroen-Galinaitis@umanitoba.ca

474-9808

Minors in Business, Arts, Music, Math, and Computer Science are offered to Engineering students. These programs help to broaden your education and increase your prospects for future employment. In order to obtain a minor you must complete 18 credit hours of courses from the given faculty.

Requirements for pursuing a minor include the completion of at least 30 credit hours toward your engineering degree, as well as a CGPA of at least 3.00. There are a limited number of spaces available in the minor programs therefore preference is given to students who are closest to completing their degree.

Visit the Engineering Undergraduate Student Affairs Office for more details on pursuing a minor. Applications for minors must be submitted to this office before the end of May.

\*With the approval of the Faculty of Engineering, courses taken to complete minors may also be used to fulfill engineering course requirements.





## Summer Research Opportunities

The following is a list of research topics shared in the Fall 2016 term for potential summer research student positions. For more information about specific opportunities we have provided the contact information for the professors.

- **Shawn Clark – Hydraulics Research and Testing Facility -**  
[Shawn.Clark@umanitoba.ca](mailto:Shawn.Clark@umanitoba.ca) E1-388
  - One or two 3rd or 4th year Civil Engineering students. Must be able to data process, has taken CIVL 2790 and preferably CIVL 2740 as well
  - Current projects include:
    - experimental physical modeling of river ice in the lab; river ice freeze-up/break-up studies that will include analysing previously acquired data as well as conducting open water field work to acquire channel bottom and flow data for river reaches of interest; field work will be undertaken on the Dauphin, Assiniboine, and Red Rivers in Manitoba
- **Marolo Alfaro – Geotechnical Engineering -** [Marolo.Alfaro@umanitoba.ca](mailto:Marolo.Alfaro@umanitoba.ca) room E1-338
  - Research Topics Include:
    - Improving the structural stability of highway embankments in the Arctic
      - Research will investigate the use of wicking geosynthetics to improve the structural stability of embankment fills. The summer student will help a PhD student in carrying out conventional and specialized laboratory tests, compiling and processing monitoring data from field instrumentation, and processing photo images taken from a drone
    - Stability evaluation of earth dams in hydroelectric generating stations
      - The research will develop safety protocols for aged earth dams. The summer student will assist a PhD student to carry out laboratory tests. The student will also generate borehole logs from computer program GINT
    - Assessment of strength mobilization in driven steel piles (with Dr. James Blatz)
      - Recent developments with the use of the Pile Driving Analyzer have allowed in-situ evaluation of the mobilized resistance during driving. The summer student will assist the MSc student with his field and laboratory works, including static pile load tests.
- **John Regehr – Transportation Engineering -** [Jonathan.Regehr@umanitoba.ca](mailto:Jonathan.Regehr@umanitoba.ca) E1-310
  - Working closely with public and private sector research sponsors, Dr. Regehr applies advanced technologies and analytics to deliver research that meets pressing needs within the transportation industry in Manitoba and beyond
  - Current research projects include:
    - estimating system-wide traffic and truck traffic flow on Manitoba's highway network; developing truck loading inputs for pavement design; modelling wheel-rail contact for improved rail infrastructure performance
  - Students working with Dr. Regehr gain practical transportation engineering experience, enhance their ability to conduct research within a team environment, and establish a strong network through numerous professional development opportunities





- **Miroslava Kavgia – Construction Engineering and Management**  
[Miroslava.Kavgic@umanitoba.ca](mailto:Miroslava.Kavgic@umanitoba.ca) E1-442

**Deadlines are February 15, 2017 for URA and January 20, 2017 for USRA**  
**\*dates will be updated in Fall 2017 for Summer 2018 opportunities.**



## What are 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 there are not formal specializations designated on transcripts.



## Course List

### Second Year Courses

Introduction to Physical Chemistry (CHEM 1310) 3CR  
Solid Mechanics (CIVL 2800) 4CR  
Graphics for Civil Engineers (CIVL 2830) 2CR  
Engineering Communication (ENG 2030 or ENG 2040) 3CR  
Civil Engineering Geomatics (CIVL 2840) 3CR  
Math Analysis 1 (MATH 2130) 3CR  
Contemporary Statistics for Engineers (STAT 2220) 3CR  
Civil Engineering Materials (CIVL 2770) 5CR  
Civil Engineering Systems (CIVL 2780) 4CR  
Fluid Mechanics (CIVL 2790) 4CR  
Numerical Methods (CIVL 3590) 4CR  
Geology for Engineers (GEOL 2250) 4CR  
Math Analysis 2 (MATH 2132) 3CR

### Third Year Courses

Environmental Engineering Analysis (CIVL 3690) 4CR  
Geotechnical Materials and Analysis (CIVL 3730) 4CR  
Hydrology (CIVL 3750) 4CR  
Structural Analysis (CIVL 3760) 4CR  
Transportation Engineering 1 (CIVL 3790) 4CR  
Environmental Engineering Design (CIVL 3700) 4CR  
Hydraulics (CIVL 3740) 4CR  
Structural Design 1 (CIVL 3770) 4CR  
Engineering Economics (CIVL 4050) 3CR  
Environmental Ethics (PHIL 2750) 3CR [or a complementary elective]

### 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  
Technology, Society, and the Future (CIVL 4460) 3CR  
Design Project (CIVL 4590) 6CR

### Technical Electives



Finite Element Analysis (CIVL 3710) 4CR  
Masonry Design (CIVL 4020) 4CR  
Design of Concrete Mix (CIVL 4022) 4CR  
Structural Design 3 (CIVL 4030) 4CR  
Engineering Management and Environment (CIVL 4100) 4CR  
Structural Dynamics (CIVL 4040) 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  
Groundwater Hydrology (CIVL 4250) 4CR  
Design of Urban Water Systems (CIVL 4300) 4CR  
Hazardous Waste (CIVL 4350) 4CR  
Transportation Systems (CIVL 4410) 4CR  
Highway Pavement Design (CIVL 4420) 4CR  
Watershed Processes (CIVL 4470) 4CR  
Air Pollution (BIOE 4460) 4CR  
Remediation of Contaminated Soil (SOIL 4500) 3CR  
Structural Design in Wood (BIOE 4560) 4CR



# Course Descriptions

## SECOND YEAR COURSE DESCRIPTIONS

### **Introduction to Physical Chemistry (CHEM 1310) 3CR**

Thermochemistry, chemical thermodynamics, and chemical kinetics. CHEM 1300 is a prerequisite.

**Difficulty:** 3.5 **Workload:** 4

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

### **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. MATH 1710/1700 and ENG 1440 are prerequisites.

**Difficulty:** 3.5 **Workload:** 3.5

### **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. CIVL 2840 is corequisite.

**Difficulty:** 3 **Workload:** 3

### **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.

### **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. MATH 1210 and CIVL 2030 are corequisites.

**Difficulty: 3    Workload: 2**

### **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. MATH 1710 and MATH 1210 are prerequisites.

**Difficulty: 3    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.

### **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. 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.

### **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. MATH 1710/1700 is a prerequisite.

**Difficulty: 3    Workload: 3**

### **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. ENG 1440 and MATH 1710 are prerequisites.

**Difficulty: 4    Workload: 3.5**

### **Numerical Methods (CIVL 3590) 4CR**

Variety of numerical techniques applicable to solutions of problems in civil engineering. COMP 1012 is a prerequisite and MATH 2132 is a corequisite.

**Difficulty: 3.5    Workload: 3**

### **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, landsliding, processes of weathering, transportation and geomorphology. no prerequisites.

**Difficulty: 3    Workload: 3**

### **Math Analysis 2 (MATH 2132) 3CR**

(Lab required) Infinite series, Taylor and Maclaurin Series; ordinary differential equations including Laplace transforms. For Engineering and Geophysics students only. MATH 1210 and MATH 1710 are prerequisites.

**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.





## THIRD YEAR COURSE DESCRIPTIONS

### **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. CHEM 1310/2560 are prerequisites.

### **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.

### **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. STAT 2220 is a corequisite.

### **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.

### **Transportation Eng 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.

### **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**

### **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. CIVL 2790 is a prerequisite.

**Difficulty: 3    Workload: 3**

### **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**

### **Engineering Economics (CIVL 4050) 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. STAT 2220 is a prerequisite.

**Difficulty: 3    Workload: 3**

**Tips:** Practice makes perfect!

### **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.



## FOURTH YEAR COURSE 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; geoenvironmental issues; tailing dams, clean-up, and remediation. CIVL 3730 is a prerequisite.

### **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.

### **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.

### **Transportation Engineering 2 (CIVL 4400) 4CR**

Fundamentals of traffic control for highways. Capacity and level of service analysis on urban streets. 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. Basic pavement design methods. Introduction to pavement management systems. Highway accidents and design for safety. Legislative and policy framework for transportation engineering. CIVL 3790 is a prerequisite.

### **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.

### **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**



## TECHNICAL ELECTIVES COURSE DESCRIPTIONS

### **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.

### **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.

### **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. CIVL 2770 is a prerequisite.

### **Structural Design 3 (CIVL 4030) 4CR**

Prestressed concrete structures; fibre-reinforced concrete structures; bridge loading, analysis and design in steel and concrete; special topics in structural engineering. CIVL 2770, 2800, 3760, 3770, 4390 are prerequisites.

**Difficulty: 3    Workload: 3**

### **Eng Management and Environment (CIVL 4100) 4 CR**

Teams of students apply environmental management techniques, such as: impact assessment, site assessment, and auditing to selected engineering construction projects and operations; several oral and written reports are required. CIVL 3700 is a pre- or corequisite.

### **Structural Dynamics (CIVL 4040) 4CR**

Dynamic loads in civil engineering; overview of structural dynamics; single-degree-of-freedom systems; free-vibration, harmonic, periodic and impulsive loads; multi-degree-of-freedom systems; distributed systems; beam vibrations; steady-state vibrations of foundations; introduction to earthquake engineering; elastic waves in soils, response and design spectrums; wind vibrations. CIVL 3760 is a prerequisite.



### **Water Treatment Plant Design (CIVL 4120) 4CR**

Design of unit processes used in potable water treatment plants: solid/liquid separation, oxidation, coagulation, filtration, adsorption and disinfection. Determination of design parameters through laboratory studies. Water treatment plants design standards and guidelines. CIVL 3690 is a prerequisite.

### **Solid Waste (CIVL 4130) 4CR**

Engineering principles and the practice of integrated management of solid wastes, including characteristics, sorting, utilization and final disposal in landfill. Principles of leachate and hazardous waste management and disposal. CIVL 3700 is a pre- or corequisite.

### **Environmental Systems (CIVL 4180) 4CR**

Development of a river water quality model; waste allocation modelling; modelling of the sites selection process; analysis of environmental impact using technical and non-technical (i.e. sociological, ethical, aesthetic) parameters. CIVL 2780, 3690, 3750 are prerequisites.

### **Groundwater Contamination (CIVL 4200) 4CR**

Introduction to the principles of groundwater chemistry; chemical evolution of natural groundwater flow systems; sources of contamination; mass transport processes; hydrochemical behaviour of contaminants; nuclear waste disposal; non-aqueous phase organics; aquifer remediation. CIVL 4250, GEOL 2250 are prerequisites.

### **Geotechnical Engineering (CIVL 4230) 4CR**

Case-history approach to geotechnical engineering practice from civil and mining engineering; relationship between predicted and observed behaviour; surface and shallow footings; propped walls and bulkheads; rock and soft ground tunneling; deep foundations; rock and soil slopes; culverts; geoenvironmental problems. CIVL 3730 is a prerequisite.

**Difficulty: 3    Workload: 3**

### **Groundwater Hydrology (CIVL 4250) 4CR**

Introduction to theory of groundwater flow; flow nets; regional groundwater flow; well hydraulics; role of groundwater in geologic and engineering processes; multiphase flow. GEOL 2250, CIVL 2790 MATH 2130, 2132 (or 2110) are prerequisites.

### **Design of Urban Water Systems (CIVL 4300) 4CR**

Water supply and the design of water distribution systems. Urban hydrology and design of wastewater and stormwater collection systems. Manitoba specific applications will be discussed. CIVL 3750 is a prerequisite and CIVL 3740 is a pre- or corequisite.



### **Hazardous Waste (CIVL 4350) 4CR**

Sources and classification of hazardous and industrial wastes. Overview of the waste management problem. Theory and applications of various physical, chemical, and thermal, waste treatment processes. Waste elimination options and strategies. CIVL 3690 is a prerequisite.

### **Transportation Systems (CIVL 4410) 4CR**

Contemporary approaches to transportation planning. Data for transportation planning. Advanced demand analysis and modelling. Illustrative transport planning studies. Planning and design for public passenger transportation. Planning and design for barrier-free transportation and transport of disabled persons. Goods movement and trucking studies. Planning and design for motor carrier operations. Planning and design for grain handling and transportation. Transport planning in developing countries. Evaluating transport plans and projects. Transport and the environment. Transport and energy. Vehicle operating costs and engineering unit cost models. CIVL 3790 is a prerequisite.

### **Highway Pavement Design (CIVL 4420) 4CR**

Soil classification and properties; soil-moisture-density-strength relationships; earthwork operations and specifications; soil stabilization; granular bases; surface drainage; structural design of flexible and rigid pavements. CIVL 2770 and 3790 are prerequisites.

**Difficulty: 3    Workload: 3**

### **Watershed Processes (CIVL 4470) 4CR**

Rainfall-runoff processes, flood routing; characteristics and mechanics of flow in (natural) channels; computer modelling of watershed hydrology and hydraulics; influence of man-made structures; river morphology, sediment transport prediction, design of a stable channel; river ice processes. CIVL 3750 is a prerequisite and CIVL 3740 is a pre- or corequisite.

### **Air Pollution (BIOE 4460) 4CR**

Air pollutant sources and characteristics, their impact on the environment, their behaviour in the atmosphere. Methods of sampling and measurement and the basic technological alternatives available for separation/removal and control. Particular problems of regional interest are discussed. CIVL 2790 is a pre- or corequisite.

**Difficulty: 2    Workload: 2.5**

### **Remediation of Contaminated Soil (SOIL 4500) 3CR**





Physical, chemical and biological approaches to remediation of land including; nature of contaminants, procedures for assessing the extent of the impact, consequences to the environment, approaches to remediation and case studies of contaminant remediation.

**Structural Design in Wood (BIOE 4560) 4CR**

Design using wood as a structural material in light-frame buildings. Consideration of design constraints associated with sawn lumber as well as based composite materials. Emphasis on use of computer based design aids. CIVL 3770 is a prerequisite.

**Difficulty: 3    Workload: 3**



## Glossary

These are a few terms that may be helpful to know throughout your studies in our faculty.

- **APEGM:** The Association of Professional Engineers and Geoscientists of Manitoba. This organization governs the work of all Professional Engineers and Geoscientists in Manitoba.
- **CFES:** The Canadian Federation of Engineering Students (which includes U of M). This national organization provides a diverse range of services as they work to support a number of Canadian Engineering schools.
- **Co-Requisite:** Refers to a course which must be taken concurrently with another course.
- **EngO:** The U of M's Engineering Orientation, also known as the two funnest days of the year. Be sure to attend on September 8<sup>th</sup> and 9<sup>th</sup>!
- **Frosh:** Refers to a first-year student.
- **HIRED:** Helping Industry Reach Engineers Directly. These sessions are held every Monday evening and provide students the opportunity to interact with industry (there's free pizza!).
- **Lab:** Refers to the portion of a course involving hands-on experiments. Most labs also require the submission of an individual or group report.
- **Midterm:** Most courses include one or two midterm exams which cover a selected portion of the course content. Although they come up quickly, midterms serve as an effective tool to keep updated with course material.
- **Prerequisite:** Refers to a course which must be completed prior to registration for another course.
- **TA:** Teaching Assistant. TAs will usually be available to students during labs/tutorials and can be very helpful in answering questions.
- **Technical Societies:** Also called "Tech Socs", this term refers to the many engineering student groups associated with UMES. Tech Soc lounges are located on the fifth floor of E1.
- **The Window:** Opens onto the Engineering Atrium and is a great resource for all engineering students. Stop by The Window to purchase snacks, UMES merchandise and event tickets or to simply ask questions.
- **Tutorial:** Refers to the portion of a course involving practice problems. Some tutorials require these questions be submitted while others do not.
- **UMES:** The University of Manitoba Engineering Society. Refers to the faculty student council which coordinates many important events and services.
- **WESST:** The Western Engineering Students' Societies Team (which includes U of M). WESST provides a diverse range of services to its 10 Western Canadian member schools.