CIVIL ENGINEERING (CVG)

Courses in civil engineering (CVG) are offered by the Faculty of Engineering

CVG 1107 Civil Engineering Graphics and Seminars (3 units)

Fundamentals of graphical communications. Sketching, orthographic projections, sectional views, basic dimensioning, axonometric drawings, auxiliary views, relationships between lines and planes in space, intersections and developments, fasteners, AutoCAD. Drawing of points, lines, curves, splines, 2D views (with dimensions) and 3D views on AutoCAD. Use of Layers. A project using AutoCAD. Seminars in Civil Engineering practice including ethics, environmental obligations and workplace health and safety.
Course Component: Laboratory, Lecture

CVG 1507 Dessin industriel et séminaires en génie civil (3 crédits)

Notions fondamentales en communication graphique. Exécution de croquis, projections orthographiques, sections, représentations axonométriques, vues auxiliaires, relations entre lignes et surfaces dans l'espace, lignes d'intersections et développement, éléments d'attache. AutoCAD. Dessin des points, lignes, courbes, splines, vues en 2D (avec cotations) et des vues en 3D. Utilisation des niveaux. Un projet utilisant AutoCAD. Séminaires consacrés à divers sujets dans la pratique de génie civil incluant l'éthique professionnelle, les obligations en matières d'environnement et les aspects de santé et sécurité au travail.
Volet : Laboratoire, Cours magistral

CVG 2107 Geotechnical Materials and Processes (3 units)

Nature and behaviour of materials forming earth's crust: their formation and alteration due to action of ice, water, and wind; glaciation; land heave; permafrost; residual soils. Basic physical properties of soils: structure; index properties; grain size and visual identification; consistency limits; organic content; classification; compaction; capillarity; shrinkage and swelling; water in soil.
Course Component: Laboratory, Lecture

CVG 2116 Introduction to Fluid Mechanics (3 units)

Fluid statics, atmospheric stability, properties of fluids. Kinematics of fluids, analysis by continuity, energy and momentum equations. Applications of one-dimensional method to flow in pipelines, flow measurement, dynamic forces and turbo machines. Laminar and turbulent pipe flow; energy losses in pipe flow and open channel flow. Viscous and form drag in fluid flow; role of boundary layer in drag. Similitude and dimensional analysis with application to hydraulic models.
Course Component: Laboratory, Lecture, Tutorial
Prerequisites: GNG 1105, MAT 1322, PHY 1122.

CVG 2132 Fundamentals of Environmental Engineering (3 units)

An introductory study of environmental resources and their use. Relations and cycles within ecosystems. The causes, monitoring and correction of pollution of environmental systems. Water quality. Examination of water and wastewater for physical, chemical and biological characteristics.
Course Component: Laboratory, Lecture, Tutorial
Prerequisite: CHM 1311.

CVG 2140 Mechanics of Materials I (3 units)

Stress and strain, mechanical properties of materials, bending moment and shear force diagrams; stresses and deformations in members subjected to tension, compression, shear and torsion; flexural and shearing stresses in beams; deflection of beams; combined stresses.
Course Component: Lecture, Tutorial
Prerequisite: GNG 1105.

CVG 2141 Civil Engineering Materials (3 units)

Chemical, physical and mechanical properties of steels. Concrete materials and mix design. Properties of fresh and hardened concrete. Structure, properties and utilization of timber.
Course Component: Laboratory, Lecture
Prerequisite: CHM 1311.

CVG 2149 Civil Engineering Mechanics (3 units)

Basic concepts of engineering mechanics applicable to civil engineering. Analysis of statically determinate beams, trusses and cables. Conservation of energy, principle of impulse and momentum, angular momentum, and impact for particles and systems of particles. Kinematics of particles, system of particles and rigid bodies. D'Alembert's principle.
Course Component: Lecture, Tutorial
Prerequisites: GNG 1105, MAT 1322, PHY 1122.

CVG 2170 Measurements I (4 units)

Principles and analysis of civil engineering measurements. Probability and normal distribution; systematic and random errors; probabilistic principles of errors; statistical treatment of experimental data. Basic theory of mechanical and electrical strain measurement systems. Measurements in water resources and geotechnical engineering.
Course Component: Research, Discussion Group, Laboratory, Lecture, Seminar, Work Term, Theory and Laboratory, Tutorial
Prerequisites: MAT 1320, MAT 1322, MAT 1341.

CVG 2171 Surveying and Measurements (3 units)

Theory and technique of linear and angular measurements in plane surveying. Surveying instruments: Level, Theodolite, EDM and Total Station. Topographic surveys and mapping. Astronomical observations: solar and star (Polaris) observations. Route surveying: horizontal and vertical curves. Measurements of volumes. Principles of photogrammetry. Includes field work on practical applications of measurement theories using surveying equipment
Course Component: Lecture, Tutorial

CVG 2181 Numerical Modelling in Civil Engineering (3 units)

Development of computer programs in environmental geotechnical, structural and water resources engineering fields. Formulation of ordinary and partial differential equations with particular emphasis on civil engineering problems. Use of both microcomputers and mainframe facilities will be emphasized.
Course Component: Laboratory, Lecture
Prerequisites: (GNG 1106 or ITI 1120), MAT 2322, MAT 2384.

CVG 2507 Matériaux et processus géotechniques (3 crédits)

Nature et comportement des matériaux formant la croûte terrestre : leur formation et altération par l'action de la glace, de l'eau, du vent; glaciation; soulèvement terrestre; pergélisols; sols résiduels; structure; propriétés physiques fondamentales des sols; indices de propriétés; granulométrie et identification visuelle; limites de consistance; composition organique; classification; compactage; capillarité; retrait et gonflement; l'eau dans le sol.
Volet : Laboratoire, Cours magistral

CVG 2516 Mécanique élémentaire des fluides (3 crédits)

Hydrostatique, stabilité de l'atmosphère, les caractéristiques des fluides; kinématique des fluides, analyse par les méthodes de continuité d'énergie et d'impulsion. Applications de la méthode unidimensionnelle au débit en tuyaux, mesure des débits, forces dynamiques et machines hydrauliques; débit tranquille et turbulent (en tuyaux); pertes d'énergie pour les débits en tuyaux et aux canaux à ciel ouvert; résistance aux fluides dûe à la viscosité et à la forme. Rôle de la couche superficielle en résistance; similitude et analyse dimensionnelle avec applications aux modèles hydrauliques.
Volet : Laboratoire, Cours magistral, Tutoriel
Préalables : GNG 1505, MAT 1722, PHY 1522.

CVG 2532 Principes fondamentaux du génie de l'environnement (3 crédits)

Une étude introductive des resssources environnementales et de leur utilisation. Relation et cycles dans les écosystèmes. Bilan de matière et de l'énergie pour expliquer les phénomènes environnementaux. Les causes, la surveillance, la prévention et les mesures correctives de la pollution des systèmes environnementaux. Qualité de l'eau. Analyse de l'eau et des eaux usées en termes des caractéristiques physiques, chimiques et biologiques. Météorologie et dispersion des polluants dans l'atmosphère.
Volet : Laboratoire, Cours magistral, Tutoriel
Préalable : CHM 1711.

CVG 2540 Mécanique des matériaux I (3 crédits)

Contrainte et déformation, propriétés mécaniques des matériaux, moment de flexion et effort tranchant; contraintes et déformations dues aux forces axiales, de flexion et de torsion; contraintes de flexion et de cisaillement dans les poutres; déflexions; contraintes combinées.
Volet : Cours magistral, Tutoriel
Préalable : GNG 1505.

CVG 2541 Matériaux du génie civil (3 crédits)

Propriétés chimiques, physiques et mécaniques des aciers. Matériaux constitutifs et formulation des bétons. Propriétés du béton frais et durci. Structure, propriétés et utilisation de bois de construction.
Volet : Laboratoire, Cours magistral
Préalable : CHM 1711.

CVG 2549 Mécanique de génie civil (3 crédits)

Concepts de base de génie mécanique appliqués au génie civil. Étude des poutres statiquement déterminées, des treillis et des câbles. Conservation de l'énergie. Principe de l'impulsion et de la quantité de mouvement. Moment angulaire et impact des particules et des systèmes de particules. Cinématique des particules, de système de particules et des corps rigides. Le principe de D'Alembert.
Volet : Cours magistral, Tutoriel
Préalables : GNG 1505, MAT 1722, PHY 1522.

CVG 2571 Mesures et arpentage (3 crédits)

Théorie et technique des mesures linéaires et angulaires. Instruments d'arpentage: niveau, théodolite, EDM et station total. Topographie et cartographie. Observations astronomiques solaires et astrales (Étoiles du Nord). Arpentage des routes: courbes horizontales et verticales. Mesures des volumes. Principes de la photogrammétrie. Travail pratique sur le terrain portant sur des mesures d'arpentage.
Volet : Cours magistral, Tutoriel

CVG 2581 Méthodes numériques en génie civil (3 crédits)

Le développement de logiciels spécialisés dans les domaines de l environnement, de la géotechnique, des structures et des ressources hydriques. La formulation d'équations différentielles ordinaires et aux dérivées partielles avec un emphase sur la résolution de problèmes typiques en génie civil. Une attention particulière sera accordée à l application de ces outils au moyen de micro-ordinateurs ainsi que d ordinateurs centraux.
Volet : Laboratoire, Cours magistral
Préalables : (GNG 1506 ou ITI 1520), MAT 2722, MAT 2784.

CVG 3106 Soil Mechanics II (3 units)

Review of soil properties; site investigation methods; bearing capacity of shallow foundations; allowable bearing capacity and settlement analysis; lateral earth pressures; retaining wall design; sheet pile walls and braced cuts; slope stability analysis.
Course Component: Lecture, Tutorial
Prerequisite: CVG 3109.

CVG 3109 Soil Mechanics I (3 units)

Fundamental characteristics of soils; total and effective stresses; permeability and seepage; stress and strain, shear strength; stress distribution; consolidation and settlements.
Course Component: Laboratory, Lecture, Tutorial
Prerequisites: CVG 2107, CVG 2140.

CVG 3116 Hydraulics (3 units)

Review of fundamentals; flow in complex pipe systems; theory and operations of centrifugal pumps; gradually-varied open channel flows; backwater computations; flow measurements; unsteady flows; hydraulic models; sediment transport theory; introduction to wave theory.
Course Component: Laboratory, Lecture, Tutorial
Prerequisite: CVG 2116.

CVG 3120 Hydrology (3 units)

Hydrologic cycle; evaporation and transpiration; snow and snowmelt; infiltration; subsurface water; well hydraulics; stream flow; unit hydrograph and S-curve analysis of flood flows; river and reservoir routing techniques; statistics of extreme values.
Course Component: Lecture, Tutorial
Prerequisite: STA 2391.

CVG 3132 Physical/Chemical Unit Operation of Water and Wastewater Treatment (3 units)

Water and wastewater treatment objectives. Theory and design of the fundamental physical/chemical unit operations for water and wastewater treatment. Flow regimes in reactors and mass balances. Unit operations: sedimentation, mixers, flocculation, mass transfer/aeration, filtration, softening and disinfection.
Course Component: Laboratory, Lecture, Tutorial
Prerequisites: CVG 2116, CVG 2132.

CVG 3140 Theory of Structures I (3 units)

Analysis of statically determinate beams and frames. Deflections; moment-area method, conjugate-beam method, virtual work and energy methods. Analysis of statically indeterminate beams, frames and trusses; force method, flexibility method, slope-deflection method, moment distribution. Influence lines for beams, frames and trusses. Analysis of statically determinate cables and arches. Introduction to loads on structures.

Course Component: Lecture, Tutorial

Prerequisites: CVG 2140, CVG 2149.

CVG 3141 Mechanics of Materials II (3 units)

Combined stresses; buckling; unsymmetric bending, composite beams, inelastic bending, plastic collapse of beams, shear flow, shear centre; vibrations; Castigliano's theorem; torsion of thin-walled closed and open sections, inelastic torsion.

Course Component: Laboratory, Lecture

Prerequisites: CVG 2140, CVG 2149, MAT 2384.

CVG 3147 Structural Steel Design I (3 units)

Design of statically determinate steel structures. Limit States Design. Properties of structural steel. Loads from building codes. Tributary area. Live-load-reduction factors. Tension members: Effective area, shear lags. Compression members: strength and stability. Beams: Plastic flexure, local and lateral torsional buckling, shear strength, deflection control, bearing resistance. Structural bolts in shear, tension, and in combination; prying action.

Course Component: Lecture, Tutorial

Prerequisites: CVG 2141, CVG 3140. STA 2391 is corequisite to CVG 3147.

CVG 3148 Reinforced Concrete Design I (3 units)

Behaviour and design of reinforced concrete members subjected to bending, shear and axial force. Analysis of reinforced concrete sections. Design of beams, one-way slabs, columns, bearing walls and retaining walls using the ultimate strength theory and the principles of limit states design. Introduction to prestressed concrete. Design of simple prestressed concrete beams.

Course Component: Laboratory, Lecture

Prerequisites: CVG 2141, CVG 3140.

CVG 3506 Mécanique des sols II (3 crédits)

Révision des propriétés du sol ; méthodes d'investigation du site ; capacité portante des fondations peu profondes ; capacité portante admissible et analyse du tassement ; pressions latérales du sol ; conception des murs de soutènement ; murs de palplanches et coupes contreventées ; analyse de la stabilité des pentes.

Volet : Cours magistral, Tutoriel

Préalable : CVG 3509.

CVG 3509 Mécanique des sols I (3 crédits)

Caractéristiques fondamentales des sols ; contraintes totales et effectives ; perméabilité et infiltration ; contraintes et déformations relatives, résistance au cisaillement ; répartition des contraintes ; consolidation et tassement.

Volet : Laboratoire, Cours magistral, Tutoriel

Prealables : CVG 2507, CVG 2540.

CVG 3516 Hydraulique (3 crédits)

Révision des principes fondamentaux ; écoulement dans les systèmes complexes de conduites ; théorie et opération de pompes centrifuges ; écoulements à surface libre graduellement variés ; calcul de courbes de remous ; mesure de débit ; écoulements non stationnaires ; modèles hydrauliques ; théorie de transport de sédiments ; introduction à la théorie des vagues.

Volet : Laboratoire, Cours magistral, Tutoriel

Préalable : CVG 2516.

CVG 3520 Hydrologie (3 crédits)

Cycle hydrologique; évaporation et transpiration; neige et fonte des des neiges; infiltration; eaux souterraines; hydraulique des puits; débit; analyse par hydrogramme unitaire et hydrogramme en S des débits d'inondation; techniques de routage en rivière et en réservoir; statistiques des valeurs extrêmes.

Volet : Cours magistral, Tutoriel

Préalable : STA 2791.

CVG 3532 Opérations unitaires physiques/chimiques du traitement de l'eau et des eaux usées (3 crédits)

Objectifs du traitement de l'eau et des eaux usées. Théorie et conception des opérations unitaires physiques/chimiques fondamentales pour le traitement de l'eau et des eaux usées. Régimes d'écoulement dans les réacteurs et bilans massiques. Opérations unitaires : sédimentation, mélangeurs, floculation, transfert de masse/aération, filtration, adoucissement et désinfection.

Volet : Laboratoire, Cours magistral, Tutoriel

Préalables : CVG 2516, CVG 2532.

CVG 3540 Théorie des structures I (3 crédits)

Analyse de poutres et cadres isostatiques. Calcul des flèches ; méthode des moments d'aire, méthode de poutre conjuguée, travail virtuel et méthodes d'énergie. Analyse de poutres, cadres et treillis hyperstatiques ; méthodes des forces, de flexibilité, des rotations, de distribution de moments. Lignes d'influence pour poutres, cadres et treillis. Analyse de câbles et arcs isostatiques. Introduction aux surcharges sur les structures.

Volet : Cours magistral, Tutoriel

Préalables : CVG 2540, CVG 2549.

CVG 3547 Conception des structures en acier I (3 crédits)

Calculs et conception de structures isostatiques en acier. Calculs aux états limites. Propriétés de l'acier. Charges selon les normes de bâtiments. Aires tributaires. Facteurs de réduction des surcharges d'exploitation. Pièces en traction: section effective, décalage. Pièces en compression : résistance et comportement en stabilité. Poutres: moment plastique, voilement des sections à parois minces, déversement, résistance à l'effort tranchant, contrôle de déformations, résistance aux charges concentrées. Résistance des boulons en cisaillement, en traction et en cisaillement et traction combinés, effet de levier.

Volet : Cours magistral, Tutoriel

Préalables : CVG 2541, CVG 3140. STA 2791 est concomitant à CVG 3547.

CVG 3548 Conception des structures en béton armé I (3 crédits)

Comportement et conception des éléments en béton armé soumis à la flexion, au cisaillement et à l'effort axial. Analyse de sections en béton armé. Conception de poutres, dalles unidirectionnelles, poteaux, murs porteurs et murs de soutènement en utilisant la théorie de la résistance ultime et les principes de conception aux états limites. Introduction au béton précontraint. Conception de poutres simples en béton précontraint.
Volet : Laboratoire, Cours magistral
Préalables : CVG 2541, CVG 3540.

CVG 4001 Introduction à la conception en génie civil / Introduction to Civil Engineering Project (3 crédits / 3 units)

Introduction à la méthode de conception. Identification des critères et contraintes d'un projet. Génération des options de conception et sélection du meilleur concept. Compétences en gestion de projet telles que production d'un échéancier et allocation des ressources. / Introduction to the design method. Identification of project criteria and constraints. Generation of design options and selection of preferred design. Project management skills, such as cost prediction, timeline evaluation and resource allocation.
Volet / Course Component: Cours magistral / Lecture, Tutoriel / Tutorial
Préalables : CVG 3106, CVG 3116, CVG 3132, CVG 3147, CVG 3148.

CVG 4107 Rock Mechanics (3 units)

Rock exploration, laboratory and in-situ testing; rock mass classification; deformation and strength; failure criteria; stresses in rock; foundations on rock.
Course Component: Lecture
Prerequisites: CVG 3109, CVG 3106.

CVG 4108 Geotechnical Design (3 units)

Applications of soil mechanics theory to bearing capacity, settlement, and stability evaluation; design of foundations, retaining structures, embankments, and excavations; geotechnical exploration, reporting and spatial variability considerations; introduction to ground improvement.
Course Component: Lecture
Prerequisites: CVG 3109, CVG 3106.

CVG 4110 Hydraulics of Open Channels (3 units)

Equations of open channel flow. Rapidly varied flow. Gradually varied flow in regular and natural channels. Unsteady flow. Application to flood waves and tides in natural channels. Turbulence and related diffusion phenomena. Sediment transport, bed and suspended load. Scour.
Course Component: Lecture
Prerequisites: CVG 3116, CVG 3120.

CVG 4113 Hydraulics of Water Supply and Sewer Systems (3 units)

Population forecasting techniques. Design of network distribution systems for flow and pressure requirements, hydraulics of sewer junctions and transitions, measuring devices in urban water and sewer networks, pumps, and pumping stations, valves, hydrants. Environmental considerations. Fieldwork.
Course Component: Lecture
Prerequisite: CVG 3116.

CVG 4122 Groundwater and Seepage (3 units)

Types and physical properties of aquifers. Darcy's Law; hydraulic conductivity of isotropic, anisotropic, and multilayered soils; uniform flow, unidirectional and radial flow -- steady and unsteady flow nets; methods of images, partially penetrating wells; leaky aquifers; application of mapping techniques to seepage problems.
Course Component: Lecture
Prerequisites: CVG 2116, CVG 3109.

CVG 4130 Advanced Environmental Engineering (3 units)

Water quality objectives; cell microbiology; bacterial energetics; biological treatment kinetics; design of conventional wastewater treatment systems (lagoons, activated sludge); design of advanced wastewater treatment systems (membrane bioreactors, and moving bed bioreactors).
Course Component: Lecture, Tutorial
Prerequisite: CVG 2132.

CVG 4133 Solid Waste Management (3 units)

Quantities and characteristics of municipal solid waste. Collection and transportation systems. Resource recovery. Solid waste separation processes. Energy recovery from municipal solid waste. Disposal methods. Environmental impacts of landfilling of solid waste. Environmental legislation and risk assessment.
Course Component: Lecture
Prerequisite: CVG 2132.

CVG 4135 Water Treatment in Northern Communities (3 units)

Specific context of water and wastewater treatment in northern communities: type of water and wastewater treatment units, type of distribution systems, major challenges related to water and wastewater services and water strategies implemented.
Course Component: Lecture
Prerequisites: CVG 3116, CVG 3120.

CVG 4142 Structural Dynamics (3 units)

Dynamic problems in civil engineering; single-degree-of-freedom system; free and forced vibrations; transient phenomena and Duhamel's integral; distributed mass system; seismic response of structures; multi-storey buildings; random vibration and wind-induced response of structures.
Course Component: Lecture
Prerequisites: CVG 3140.

CVG 4143 Structural Steel Design II (3 units)

Design of fully and partially composite beams. Beam-Columns design including local buckling, strength and stability interaction equations, biaxial bending, and bending and tension members. Plate girders design including ultimate shear strength, tension-field action, design of bearing and intermediate stiffeners, local buckling considerations, and flexural resistance. Second-order analysis techniques.
Course Component: Lecture
Prerequisites: CVG 3147, CVG 3148.

CVG 4145 Reinforced Concrete Design II (3 units)

Extension of course CVG 3148. Behaviour and design of reinforced concrete members, subjected to biaxial bending, torsion, lateral loads and two-way action. Two-way slab systems. Strip method, direct design approach and equivalent frame analysis of two-way slabs. Yieldline theory of slabs. Inelastic response of reinforced concrete structures and moment re-distribution. Earthquake resistant design.
Course Component: Lecture, Tutorial
Prerequisites: CVG 3148.

CVG 4146 Structural Design in Timber (3 units)

Timber engineering; species groups, stresses, load factors. Mechanical fasteners and adhesives. Preservative treatments; fire safety, design and analysis of timber structures.
Course Component: Lecture, Tutorial
Prerequisite: CVG 3140.

CVG 4147 Sustainable Building Design (3 units)

Basic principles of heat transfer in buildings; energy-efficient envelope design; bioclimatic design; energy use in buildings; building energy codes and standards; indoor environmental quality.
Course Component: Lecture
Prerequisites: CVG 3147, CVG 3148.

CVG 4148 Theory of Structures II (3 units)

Topics in structural analysis related to statistically indeterminate structures. Introduction to stiffness and flexibility coefficients; matrix formulation and computer programming to solve indeterminate structures such as trusses, continuous beams and tall building frames.
Course Component: Laboratory, Lecture
Prerequisites: CVG 2181, CVG 3140.

CVG 4150 Highway and Transportation Engineering (3 units)

Importance of highways and transportation; urban transportation planning; driver, vehicle, and general traffic characteristics; traffic engineering and studies; highway capacity and level of service; highway location and geometric design; earthwork operations; highway drainage and subgrade structure; structural analysis and design of rigid and flexible pavements; economic analysis and evaluation of transportation systems.
Course Component: Lecture, Tutorial
Prerequisites: CVG 2171, CVG 2107, CVG 2141.

CVG 4161 Mechanics of Unsaturated Soils (3 units)

Stress state variables for unsaturated soils interpretation; measurement of suction, permeability, shear strength, volume change behavior of unsaturated soils; application of the mechanics of unsaturated soils for geotechnical engineering problems.
Course Component: Lecture
Prerequisites: CVG 3109, CVG 3106.

CVG 4172 Advanced Concrete Technology (3 units)

Cement: types, hydration, physical properties; aggregate: classification, grading, properties; fresh concrete: influence of basis constituents and admixtures on workability, mixing, placing; strength of hardened concrete; nature of strength, influence of constituents, curing methods; durability; chemical attack, frost action, thermal effects; elasticity, shrinkage and creep; special concrete;lightweight, high density; mix design; approaches, weigh batching, volume proportioning, special mixes; field and laboratory test methods.
Course Component: Lecture
Prerequisite: CVG 2141.

CVG 4173 Construction Management (3 units)

Planning and operation of construction project by the civil engineer, co-ordination and control of personnel, materials and machines, scheduling, estimation, purchasing cost control and other topics. Influence of construction procedures on civil engineering design processes. Common and civil law as applied to engineering contracts and specifications.
Course Component: Lecture
Prerequisites: CVG 3106, CVG 3147, CVG 3148.

CVG 4175 Field Investigations and Environmental Impact Assessment of Civil Engineering Projects (3 units)

Field investigations in geotechnical, water resources and environmental engineering. Experimental design, data acquisition, data analysis and site visits. Principles of environmental impact assessment of civil engineering projects.
Course Component: Laboratory, Lecture
Prerequisites: CVG 2132, CVG 3116, CVG 3106.

CVG 4180 Special Directed Studies (3 units)

Selected topics of special interest in civil engineering.
Course Component: Research
Prerequisite: Permission of the Department.

CVG 4181 Special Topics in Structural Engineering (3 units)

Specialized course on a selected topic in structural engineering
Course Component: Lecture
Prerequisites: CVG 3147, CVG 3148.

CVG 4184 Special Topics in Geotechnical Engineering (3 units)

Specialized course on a selected topic in geotechnical engineering.
Course Component: Lecture
Prerequisite: CVG 3106.

CVG 4186 Special Topics in Water Resources Engineering (3 units)

Specialized course on a selected topic in water resources engineering.
Course Component: Lecture
Prerequisites: CVG 3116, CVG 3120.

CVG 4188 Special Topics in Environmental Engineering (3 units)

Specialized course on a selected topic in environmental engineering.
Course Component: Lecture
Prerequisites: CVG 3116, CVG 3120.

CVG 4260 Thesis (6 units)

Thesis on an approved research or design topic in Civil Engineering which will emphasize independent work. The thesis will be done under the direction of a faculty adviser and the student must obtain an adviser's approval before commencing the course.
Course Component: Research
Prerequisites: B average, permission of supervisor.

CVG 42601 Thesis (Part 1 of 2)

Thesis on an approved research or design topic in Civil Engineering which will emphasize independent work. The thesis will be done under the direction of a faculty adviser and the student must obtain an adviser's approval before commencing the course. (Part 1 of 2)
Course Component: Research
Prerequisites: B average, permission of supervisor.

CVG 42602 Thesis (Part 2 of 2) (6 units)

Thesis on an approved research or design topic in Civil Engineering which will emphasize independent work. The thesis will be done under the direction of a faculty adviser and the student must obtain an adviser's approval before commencing the course. (Part 2 of 2)
Course Component: Research
Prerequisite: CVG 42601

CVG 4907 Projet de conception en génie civil / Civil Engineering Design Project (3 crédits / 3 units)

Projet en génie civil sous la direction de conseillers membres du corps professoral pendant la dernière année du programme. Le projet doit être basé sur la connaissance et les qualifications conformes aux normes de conception, de législation, de sciences économiques, de santé et de sécurité, d'environnement et autres facteurs pertinents. Un accent particulier est mis sur l'expérience de travail en équipe et sur l'apprentissage dans un contexte créatif, itératif et ouvert. / A civil engineering design project under the direction of faculty advisors for the final year of the program. The project is to be based on the knowledge and skills of design standards, legislation, economics, health and safety, environmental and other pertinent factors. A particular emphasis is placed on experience of teamwork and a creative, iterative and open-ended process.

Volet / Course Component: Cours magistral / Lecture

Prerequisite: CVG 4001.

CVG 5101 Construction Equipment Management (3 units)

The course is designed to provide a thorough understanding of the fundamentals and basis for design and analysis of construction operations. The various types of equipment used in the construction of heavy civil projects is analyzed and evaluated. Methods are developed for selecting, acquiring, maintaining, and replacing equipment. Simulation and optimization techniques are used as well for the optimal selection of equipment.

Course Component: Lecture

This course is equivalent to CIVJ 5101 at Carleton University.

CVG 5111 Hydraulic Structures (3 units)

Classification and function of hydraulic structures; analysis and design of hydraulic works for gravity dams, arch dams, earth fill and rock-fill dams; ancillary works including water intakes, various types of spillways, control structures, energy dissipation and stilling basin, bottom outlets. Advanced topic in channel design including transitions; hydraulic transients, free surface and free surge analysis; water towers and compensation basins; penstocks. Navigation locks. Coastal protection works and maritime structures. This course is equivalent to CIVJ 5501 at Carleton University.

Course Component: Lecture

CVG 5112 Numerical modelling in water resources (3 units)

Finite volume methods for advection, diffusion and shallow water equations using structured and unstructured grids, finite volume methods for incompressible Navier-Stokes equations (SIMPLE, SIMPLEC, PISO), error analysis: numerical diffusion and dispersion, truncation errors and Fourier analysis, introduction to turbulence modeling, introduction to methods for tracking free surfaces and moving beds, introduction to other methods in hydrodynamics: finite element, finite difference, Chebyshev and Fourier spectra, semi Lagrangian and vortex methods inhydrodynamics. This course is equivalent to CIVJ 5502 at Carleton University.

Course Component: Lecture

CVG 5124 Coastal Engineering (3 units)

Key concepts in coastal engineering: (1) wave mechanics and coastal hydrodynamics, (2) sediment transport and coastal morphodynamics and (3) coastal structures and coastal zone management. Wave mechanics and coastal hydrodynamics to include small-amplitude wave theory, finite amplitude wave theories (Stokes, Cnoidal and solitary wave), wave generation, wave transformations, development and prediction, hydrodynamics of coastal circulation. Sediment transport and coastal morphodynamics to include: wave and current-induced sediment transport, coastal sediment processes, longshore and cross-shore beach morphologic transformations, etc. Coastal structures and coastal zone management to include: beach erosion control, coastal structures (dikes, breakwaters, groins, seawalls), beach nourishment, coastal pollution and control, nearshore area development. This course is equivalent to CIVJ 5605 at Carleton University.

Course Component: Lecture

CVG 5143 Advanced Structural Steel Design (3 units)

Analysis of thin-walled beams; design applications including members under combined forces; analysis and design of beams under non-uniform torsion; limit state design methodology; comparative study of modern structural steel standards; formulating elastic and plastic interaction relations for members under combined forces; designing columns, beams, and beam columns for cross-sectional strengths; local buckling and global stability considerations; design of bracing systems. This course is equivalent to CIVJ 5202 at Carleton University.

Course Component: Lecture

CVG 5144 Advanced Reinforced Concrete (3 units)

Study of the elastic and inelastic response of reinforced concrete structures under monotonic and cyclic loading. Methods for predicting structural behaviour of concrete elements. The relationship between recent research results and building codes. This course is equivalent to CIVJ 5300 at Carleton University.

Course Component: Lecture

CVG 5145 Theory of Elasticity (3 units)

Stress-strain relations. Theories of plane stress and plane strain. Use of stress functions, energy and variational methods in the analysis of elastostatic problems. This course is equivalent to CIVJ 5203 at Carleton University.

Course Component: Lecture

CVG 5149 Structural Stability (3 units)

Elastic, inelastic, and torsional buckling of columns, beam column behaviour, plane and space frame stability, lateral torsional buckling of beams, global buckling of truss systems, plate and shell buckling, local buckling in tubulars, use of energy methods, matrix analysis, and finite element analysis in modeling stability problems, bracing requirements, standard provisions and design considerations in structural stability. This course is equivalent to CIVJ 5304 at Carleton University.

Course Component: Lecture

CVG 5150 Advanced Concrete Technology (3 units)

Cement: types, hydration, physical properties; aggregate: classification, grading, properties; fresh concrete: influence of basis constituents and admixtures on workability, mixing, placing; strength of hardened concrete; nature of strength, influence of constituents, curing methods; durability; chemical attack, frost action, thermal effects; elasticity, shrinkage and creep; special concrete; lightweight, high density; mix design; approaches, weigh batching, volume proportioning, special mixes; field and laboratory test methods. This course is equivalent to CIVJ 5206 at Carleton University.

Course Component: Lecture

CVG 5151 Advanced Timber Design (3 units)

Characteristic values for timber and engineered wood products , modification factors used in design; design of members subjected to combined bending axial loading; design for bi-axial bending; design of curved glued laminated beams, Timber-Concrete Composite (TCC) floor systems; lateral design (wind and seismic loading) for light-frame, CLT and hybrid structures; advanced connection design including design of proprietary connections. This course is equivalent to CIVJ 5151 at Carleton University.

Course Component: Lecture

CVG 5153 Wind Engineering (3 units)

The structure and climate of wind; wind loading on structures; wind induced dynamic problems of structures; environmental aerodynamics; dispersion of pollutant; analysis of wind data; experimental investigations. This course is equivalent to CIVJ 5209 at Carleton University.

Course Component: Lecture

CVG 5154 Random Vibration (3 units)

Descriptions of random data. Frequency domain analysis and time domain analysis. Stochastic response of structures; wind and earthquake excitation, etc. Data analysis techniques. Prediction for design purposes. Simulation of random processes. Special topics. This course is equivalent to CIVJ 5308 at Carleton University.

Course Component: Lecture

CVG 5155 Earthquake Engineering (3 units)

Nature and characteristics of earthquake motions. Non-linear response of single and multi-degree-of-freedom structures to seismic excitations. Modal superposition technique. Simplified procedures for dynamic structural analysis. Principles of earthquake resistant design. Strength, stiffness, ductility and energy absorption requirements of structures for seismic forces. Response spectra analysis. Current design procedures for aseismic design. Recent research on earthquake engineering. This course is equivalent to CIVJ 5306 at Carleton University.

Course Component: Lecture

CVG 5156 Finite Element Methods I (3 units)

Review of basic matrix methods. Structural idealizations. The displacement versus the force method. Stiffness properties of structural elements. Finite elements in beam bending, plane stress and plate bending. This course is equivalent to CIVJ 5301 at Carleton University.

Course Component: Lecture

CVG 5157 Finite Element Methods II (3 units)

Application of finite elements to folded plates, shells and continua. Convergence criteria and order of accuracy. Inertial and initial stress properties. Dynamic and buckling problems. Non-linear deflections and plasticity. This course is equivalent to CIVJ 5303 at Carleton University.

Course Component: Lecture

CVG 5159 Long Span Structures (3 units)

Mechanics of cables. Suspension bridges and cable-stayed bridges. Space structures. Design and construction of long span structures. Dynamics of long span bridges. Case studies. Future of long span structures. This course is equivalent to CIVJ 5309 at Carleton University.

Course Component: Lecture

CVG 5160 Sediment Transport (3 units)

An introduction to particle transport, with special emphasis on river engineering applications, including natural channel design. Sediment properties, initiation of motion, bed load, suspended load, fluvial dunes, alluvial channels, bank erosion and protection, natural channel design. Special topics include contaminated sediments, local scour, morphodynamic modelling, fluvial habitat. This course is equivalent to CIVJ 5503 at Carleton University.

Course Component: Lecture

CVG 5161 Mechanics of Unsaturated Soils (3 units)

Introduction to unsaturated soils, phases of an unsaturated soil, phase properties and relations, stress state variables for saturated and unsaturated soils. Measurement of soil suction: theory of soil suction, capillarity, measurements of total suction and matric suction. Flow Laws: flow of water and measurement of permeability, shear strength theory: history, failure envelope for unsaturated soils, triaxial and direct shear tests, typical results, simple testing procedures, volume change behavior including expansive soils behavior. Soil-water characteristic curve: its behavior and use in predicting the engineering properties of unsaturated soils, practical applications of the principles of unsaturated soils. This course is equivalent to CIVJ 5106 at Carleton University.

Course Component: Lecture

CVG 5162 River Hydraulics (3 units)

Advanced concepts of river hydraulics, with an emphasis on field measurement techniques and application of numerical models. Navier-Stokes equations, turbulence, flow resistance, numerical modelling of simplified momentum and continuity equations, field-based measurement and statistical analysis of velocity fields. Special topics include contaminant transport, morphodynamic modelling. This course is equivalent to CIVJ 5504 at Carleton University.

Course Component: Lecture

CVG 5175 Numerical Methods for Geotechnical Engineers (3 units)

Non-linear analysis of stresses and deformations using the effective stress concept; analysis of consolidation using the excess pore water pressure concept; flow through porous media; finite element, discrete element and finite difference methods; applications to foundations of structures, retaining walls, dams, tunnels, pipelines, human-made and natural slopes in rock and soil. This course is equivalent to CIVJ 5105 at Carleton University.

Course Component: Lecture

CVG 5181 Decentralized Wastewater Management (3 units)

Fundamental principles and practical design applications of decentralized wastewater treatment for domestic and industrial sources. Management of decentralized wastewater systems; Pre-treatment systems; Soil infiltration systems; Advanced onsite technologies, constructed wetlands; Alternative collection systems; Wastewater reuse and septage management. This course is equivalent to CIVJ 5181 at Carleton University.

Course Component: Lecture

CVG 5182 Water Resources Management (3 units)

Global water supply and demand; Integrated water resources management; Modeling and optimization of water resources systems; Reservoir Management; Uncertainty modeling; Climate Change and water; Decision under uncertainty. This course is equivalent to CIVJ 5182 at Carleton University.

Course Component: Lecture

Courses CVG 5182, EVG 5182 cannot be combined for units.

CVG 5183 Mixing and Transport of Pollutants in Water Bodies (3 units)

Typical models for selected water resources systems : Rivers, lakes, estuaries; Water quality parameters; Conservative parameters; Non conservative parameters; Laminar and turbulent flows; Dispersion; Pollution sources; Modeling; Simplified (integral) models; Dilution models; Three Dimensional models; Advection-Diffusion Equation; Analytical solution; Numerical solution; Non-conservative transport and Multi-component systems; Modeling approaches based on conservative and non-conservative transport and kinetics; Certain water quality parameters (Temperature, Salinity, etc.). This course is equivalent to CIVJ 5183 at Carleton University.

Course Component: Lecture

Courses CVG 5183, EVG 5183 cannot be combined for units.

CVG 5184 Construction Cost Estimating (3 units)

General overview of construction cost estimating. Techniques and construction cost estimating process; Elements of project cost; Conceptual and detailed cost estimation methods; Risk assessment and range estimating; Work breakdown structure applied in building projects. Computer applications in building construction cost estimating and infrastructure projects. This course is equivalent to CIVJ 5184 at Carleton University.

Course Component: Lecture

CVG 5185 Construction Life Cycle Analysis (3 units)

General overview of analyzing the economics of construction projects by applying the concept of time value of money. Financing strategies for construction projects and profitability analysis; Correlation between Value Engineering, Life cycle cost analysis and assessment for construction projects. Break Even, Sensitivity and Risk analysis and their application to project life cycle analysis. This course is equivalent to CIVJ 5185 at Carleton University.

Course Component: Lecture

CVG 5186 Project Information Management (3 units)

Topics in contractual relationships between construction project teams. Different type of construction contracts and their application. Preparation of project documents. Evaluation of different types of project organization structure and associated project delivery systems. Bidding strategies. Network analysis using deterministic and stochastic methods for construction time and cost management. This course is equivalent to CIVJ 5186 at Carleton University.

Course Component: Lecture

CVG 5187 Rock Mechanics (3 units)

Rock exploration, laboratory and in-situ testing; rock mass classification; deformation and strength; failure criteria; stresses in rock; foundations on rock. This course is equivalent to CIVJ 5110 at Carleton University.

Course Component: Lecture

CVG 5188 Loads on Structures (3 units)

Overview of loads on buildings according to Canadian codes and standards. Dead and live loads; Snow loads; Wind loads; Earthquake loads; Loads on non-structural components; Vibrations. Selected topics in the practical design of building structures. This course is equivalent to CIVJ 5188 at Carleton University.

Course Component: Lecture

CVG 5189 Blast Engineering (3 units)

Overview of explosives and blast loads on structural and non-structural infrastructure components; dynamic analysis of elements under blast-induced shock waves and dynamic pressures; elastic and inelastic response; incremental equation of motion and nonlinear analysis; development of resistance functions; pressure-impulse (P-I) diagrams; design of blast-resistant buildings and building components, including glazed windows, curtain walls, and blast-resistant doors as per codes and standards; progressive collapse analysis; blast retrofits and blast-risk mitigation strategies. This course is equivalent to CIVJ 5189 at Carleton University.

Course Component: Lecture

CVG 5190 Rehabilitation of Concrete Structures (3 units)

Durability of concrete bridges and building structures in Canada; assessment and evaluation of damaged concrete structures; repair, rehabilitation, and strengthening techniques; applicable design codes and guidelines; monitoring technologies for structures; implications for infrastructure management. This course is equivalent to CIVJ 5190 at Carleton University

Course Component: Lecture

CVG 5191 Diagnosis and Prognosis of Concrete Infrastructure (3 units)

Condition assessment of concrete infrastructure using experimental (i.e. visual, non-destructive, microscopic and mechanical) and analytical approaches; Overview of repair and maintenance techniques according to damage type and extent; “Serviceability performance” and “appraisal guides” for aging infrastructure; Design for durability through performance based design (PBD) approaches. This course is equivalent to CIVJ 5191 at Carleton University.

Course Component: Lecture

CVG 5192 Characterization Methods for Materials (3 units)

Modern materials characterization techniques especially with respect to civil engineering materials. Choosing the right characterization methods in order to determine the properties of materials such as chemical composition, atomic structure, and surface properties used in their research. Interpreting the results of each method as well as the insight into the interrelationships between characterization methods and their interdependency. This course is equivalent to CIVJ 5192 at Carleton University.

Course Component: Lecture

CVG 5193 Instrumentation and Experimental Design for Civil Engineering (3 units)

Introduction to instrumentation in civil engineering applications; Instrument types and performance; Strain gauges; Transducers; Measurement of position, velocity, acceleration, force, pressure, temperature and flow; Data collection and data acquisition systems; Diagnostics and calibration; Control (Closed versus Open-loop); Servomotor types and servo-valves. This course is equivalent to CIVJ 5193 at Carleton University.

Course Component: Lecture

CVG 5212 Climate Change Impacts on Water Resources (3 units)

Spatiotemporal distribution of water and its impact on human activities, including domestic and municipal consumption, hydropower generation, rain-fed and irrigated agriculture, design and operation of sewer systems, floodplain zoning, navigation, etc. Critical assessment of methodologies for climate change impacts estimation. Theoretical knowledge and hands-on applications experience needed to perform climate change analysis on a water resources system. This course is equivalent to CIVJ 5212 at Carleton University.

Course Component: Lecture

CVG 5214 Sustainable and Resilient Infrastructure (3 units)

Concepts of sustainability and resiliency as applied to civil engineering infrastructure. Discussion of evolving infrastructure needs and infrastructure risk profiles due to climate and societal change. Introduction to sustainability and resiliency assessment tools including non-stationary risk assessment, triple bottom line accounting, life cycle costs, and carbon accounting. Development of infrastructure design strategies to meet objectives for both sustainability and resiliency.

Course Component: Lecture

CVG 5216 Climate-Resilient Infrastructures in a Changing Climate (3 units)

Development of a class of infrastructure with long-term sustainability and resiliency under various extreme events, particularly, the events introduced by changing climate. Climate change drivers, climate modelling and climate change impact studies. The concepts of sustainability, resiliency, and reliability. Climatic and flooding hazards. Uncertainty and non-stationarity processes as extreme events become more severe. Benefits of building sustainable and resilient infrastructures in terms of efficient capital and operational costs while providing society with healthier and more convenient infrastructure. This course is equivalent to CIVJ 5207 at Carleton University.

Course Component: Lecture

CVG 5301 Soil and Water Conservation Engineering (3 units)

The design, water quality and climate change impacts of soil and water conservation systems. Topics include: urban storm water management (including LID) erosion control practices, subsurface and surface drainage systems and irrigation technologies.

Course Component: Lecture

CVG 5308 Wastewater Treatment Principles and Design (3 units)

Theoretical aspects of unit operations and processes for wastewater treatment with design applications. Topics include wastewater characteristics, flow rates, primary treatment, chemical unit processes, biological treatment processes, advanced wastewater treatment, disinfection, biosolids treatment and disposal. Laboratory procedures: activated sludge, anaerobic growth, chemical precipitation, disinfection. Includes: Experiential Learning Activity. This course is equivalent to ENVE 5008 at Carleton University.

Course Component: Lecture

CVG 5309 Estimation and Identification in Dynamics using Data (3 units)

Dynamical systems and their computational models, probability and stochastic processes, stochastic dynamical systems, state estimation in linear dynamics using Kalman filtering, state estimation of nonlinear dynamical systems, system identification using combined state and parameter estimation, application to engineering. Includes: Experiential Learning Activity. This course is equivalent to CIVE 5109 at Carleton University.

Course Component: Lecture

CVG 5310 Advanced Computational Modeling Strategies of Historic Buildings (3 units)

Introduction to conservation engineering; commonly used construction materials in historic buildings and their constitutive laws; Graphical and numerical methods to analyze masonry arches; Theory and application of discrete element method and its applications to assess masonry buildings. This course is equivalent to CIVE 5210 at Carleton University.

Course Component: Lecture

CVG 5311 Bridge Design (3 units)

Design of highway bridges according to the Canadian Highway Bridge Design Code (CHBDC). Comparisons with other bridge codes (e.g., the American Code - AASHTO, the European, the New Zealand, and the British bridge codes). The topics covered include the following: main structural components of highway bridges; types of highway bridges; serviceability and ultimate limit state design requirements; design loads (dead loads, traffic loads, seismic loads, and wind loads); load combinations; code specifications for loading due to traffic (design lane, characteristics of design truck, positions of design truck on bridge, etc.); dynamic effects due to traffic loads; practical approaches specified in CHBDC for determining forces and deflections in structural embers; principles of capacity design in highway bridges. This course is equivalent to CIVJ 5310 at Carleton University.

Course Component: Lecture

CVG 5312 Durability of Concrete Structures (3 units)

i) Properties of cementitious materials (constituents of concrete; hydration of cement; structure of hardened concrete; transport processes in concrete); ii) deterioration of concrete (built-in problems; construction defects; cracking; dimensional stability; alkali-aggregate reaction; sulphate attack; corrosion of reinforcing steel; freezing-thawing cycles); (iii) evaluation of concrete structures (inspection; in-situ testing; laboratory testing); (iv) repair and maintenance of concrete (repair materials; repair procedures and techniques; prevention, protection and maintenance); and, (v) durability design (philosophy; modelling of deterioration processes; service life prediction; life-cycle cost analysis.) This course is equivalent to CIVJ 5311 at Carleton University.

Course Component: Lecture

CVG 5313 Seismic Analysis and Design of Concrete Structures (3 units)

Review of seismic hazards in Canada, building code provisions for earthquake loads, uniform hazard spectra, linear elastic modal response spectrum analysis, linear elastic time history analysis, equivalent static force procedure, advanced state-of-the-art nonlinear modeling techniques including the finite element method and fiber modeling, emerging methods such as performance-based earthquake engineering and displacement-based design, ductility concepts, plastic hinge formulations, capacity design philosophy for seismic resistance, seismic analysis and design of common seismic force resisting systems including slender and squat shear walls, moment resisting frames, coupled shear walls, and coupling beams, shear wallmoment resisting frame interaction, and lessons learned from recent earthquakes. This course is equivalent to CIVJ 5312 at Carleton University.
Course Component: Lecture

CVG 5314 Geotechnical Hazards (3 units)

Understanding of assessment, prevention, and mitigation of geotechnical hazards, overview of natural and man-made geo-hazards; concepts of hazards, disasters, vulnerability and risks; geotechnical hazards induced by problem soils: fundamentals, assessment, and mitigation; landslide hazards and risk assessment: fundamentals, solutions (prevention, stabilization) for landslides and slope instability; monitoring of landslides and slope; mining geotechnical hazards: hazards related to surface mining geotechnical facilities; hazards related to underground mining geotechnical facilities. This course is equivalent to CIVJ 5109 at Carleton University.
Course Component: Lecture

CVG 5333 Research Methodology (3 units)

Key components and strategies required to build a robust scientific research program in civil engineering including research questions, literature review, experiment design, data interpretation, scientific manuscripts, public speaking, ethics, and plagiarism. This course is equivalent to CIVJ 5333 at Carleton University.
Course Component: Lecture

CVG 5366 Master's Seminar in Civil Engineering

Consists of a one-semester seminar course in which each enrolled student presents once and is expected to attend and participate in all seminar sessions during that semester. It is strongly recommended to have completed coursework requirements before enrolling in this activity.
Course Component: Seminar
Graded S (Satisfactory) / NS (Not satisfactory).

CVG 6000 Projet en génie civil / Civil Engineering Report (6 crédits / 6 units)

Volet / Course Component: Recherche / Research

CVG 6108 Directed Studies I (3 units)

Special courses set up for one student on an exceptional basis. Limited to one in the Master's level and to two total Master's plus PhD. This course is equivalent to CIVE 5906 at Carleton University.
Course Component: Research
Permission of the Department is required.

CVG 6109 Directed Studies II (3 units)

Special courses set up for one student on an exceptional basis. Limited to one in the Master's level and to two total Master's plus PhD. This course is equivalent to CIVE 6906 at Carleton University.
Course Component: Research
This course is reserved for students in the PhD Civil Engineering program.

CVG 6301 Special Topics in Structures (3 units)

This course is equivalent to CIVJ 6001 at Carleton University.
Course Component: Lecture

CVG 6303 Special Topics in Structures (3 units)

This course is equivalent to CIVJ 6003 at Carleton University.
Course Component: Lecture

CVG 6304 Special Topics in Geotechnical Engineering (3 units)

This course is equivalent to CIVJ 6004 at Carleton University.
Course Component: Lecture

CVG 6305 Special Topics in Geotechnical Engineering (3 units)

This course is equivalent to CIVJ 6005 at Carleton University.
Course Component: Lecture

CVG 6306 Special Topics in Water Resources (3 units)

This course is equivalent to CIVJ 6006 at Carleton University.
Course Component: Lecture

CVG 6307 Special Topics in Water Resources (3 units)

This course is equivalent to CIVJ 6007 at Carleton University.
Course Component: Lecture

CVG 6308 Special Topics in Environmental Engineering (3 units)

This course is equivalent to CIVJ 6008 at Carleton University.
Course Component: Lecture

CVG 6309 Special Topics in Environmental Engineering (3 units)

This course is equivalent to CIVJ 6009 at Carleton University.
Course Component: Lecture

CVG 6310 Special Topics in Materials & Construction Management (3 units)

This course is equivalent to CIVJ 6010 at Carleton University.
Course Component: Lecture

CVG 6311 Special Topics in Materials & Construction Management (3 units)

This course is equivalent to CIVJ 6011 at Carleton University.
Course Component: Lecture

CVG 6508 Études dirigées I (3 crédits)

Cours individuels créés seulement pour les cas exceptionnels. Un étudiant peut en suivre un au niveau de la maîtrise ou un total de deux pour les études de maîtrise et de doctorat.
Volet : Cours magistral

CVG 6509 Études dirigées II (3 crédits)

Cours individuels créés seulement pour les cas exceptionnels. Un étudiant peut en suivre un au niveau de la maîtrise ou un total de deux pour les études de maîtrise et de doctorat.
Volet : Cours magistral

CVG 7100 Geotechnical Case Studies (3 units)

The critical study of case histories relating to current procedures of design and construction in geotechnical engineering. The importance of instrumentation and monitoring field behavior will be stressed. In-situ testing. Includes: Experiential Learning Activity. This course is equivalent to CIVE 5209 at Carleton University.
Course Component: Lecture, Seminar

CVG 7101 Advanced Soil Mechanics (3 units)

Effective stress, pore pressure parameters, saturated and partially saturated soils; seepage; permeability tensor, solutions of the Laplace equation; elastic equilibrium; anisotropy, non-homogeneity, consolidation theories; shear strength of cohesive and cohesionless soils; failure and yield criteria. This course is equivalent to CIVE 5300 at Carleton University.

Course Component: Lecture

CVG 7103 Pavement and Materials (3 units)

An analysis of the interaction of materials, traffic, and climate in the planning, design construction, evaluation, maintenance, and rehabilitation of highway and airport pavements. This course is equivalent to CIVE 5303 at Carleton University.

Course Component: Lecture

CVG 7104 Earth Retaining Structures (3 units)

Approaches to the theoretical and semi-empirical analysis of earth retaining structures. Review of the earth pressure theories. Analysis and design methods for rigid and flexible retaining walls, braced excavations, and tunnels. Instrumentation and performance studies. This course is equivalent to CIVE 5500 at Carleton University.

Course Component: Lecture

CVG 7105 advanced Foundation Engineering (3 units)

Review of methods of estimating compression and shear strength of soils. Bearing capacity of shallow and deep foundations. Foundations in slopes. Pile groups. Use of in-situ testing for design purposes. This course is equivalent to CIVE 5501 at Carleton University.

Course Component: Lecture

CVG 7107 Numerical Methods in Geomechanics (3 units)

Advanced theories of soil and rock behavior. Plasticity models. Generalized failure criteria. Critical state and cap models. Dilatancy effects. Associative and non-associative flow rules. Hardening rules. Consolidation, visco-elasticity, creep behavior. Finite element formulation. Iterative schemes. Time marching schemes. Solution of typical boundary value problems. This course is equivalent to CIVE 5503 at Carleton University.

Course Component: Lecture

Prerequisites: CVG 7120, CVG 7122.

CVG 7109 Geotechnical Earthquake Engineering (3 units)

Seismic hazards, earthquakes and ground motion, wave propagation, ground response analysis, soil properties for dynamic analysis: laboratory tests, in-situ tests, modulus and damping curves, liquefaction susceptibility, post liquefaction response, seismic effects on slope stability, retaining structures. This course is equivalent to CIVE 5505 at Carleton University.

Course Component: Lecture

CVG 7110 Road Safety Analysis (3 units)

Fundamental analytical techniques for road safety analysis, background of traffic safety analysis, network screening, before and after analysis, and surrogate measures of safety. This course is equivalent to CIVE 5310 at Carleton University.

Course Component: Lecture

CVG 7111 Advanced Building Characterization, Conservation and Rehabilitation (3 units)

Supporting concepts and techniques for the identification, documentation, and conservation of heritage and existing buildings; advanced workshops by experts from key disciplines and practice areas in heritage conservation. Includes: Experiential Learning Activity. This course is equivalent to CIVE 5603 at Carleton University

Course Component: Laboratory, Lecture

CVG 7112 Wood structures and fire (3 units)

Introduction to fire-safe design of wood buildings, brief review of wood products and wood design, prescriptive code requirements, determination of fire-resistance of wood structures through different methods. Includes: Experiential Learning Activity. This course is equivalent to CIVE 5616 at Carleton University.

Course Component: Laboratory, Lecture

CVG 7113 Practical applications of fire protection (3 units)

Introduction to the practical application of fire protection engineering from a consulting and a regulatory perspective. Main highlights include performance-based design, fire forensics, emergency preparedness and firefighting. This course is equivalent to CIVE 5617 at Carleton University.

Course Component: Lecture

CVG 7114 Probability, Statistics, Stochastic Processes and Statistical Inference in Engineering (3 units)

Fundamental of probability and statistics, (robust and ridge) regression, generalized linear models, sparse models, mixture models, stochastic processes, statistical inference and applications. Includes: Experiential Learning Activity. This course is equivalent to CIVE 5604 at Carleton University.

Course Component: Laboratory, Lecture

CVG 7115 Structural Assessment of Historic Buildings (3 units)

General concepts related to conservation of heritage structures; materials, construction techniques and structural components; classical structural analysis approaches; seismic behaviour, damage and collapse mechanisms of historic buildings; modern conservation criteria and practical implementation of repair or strengthening strategies. This course is equivalent to CIVE 5202 at Carleton University.

Course Component: Lecture

CVG 7116 Fundamentals of Geomechanics (3 units)

Tensor calculus, Cauchy stress, kinematics of continuum deformation (strain), elasticity for geomaterials, plasticity for geomaterials, constitutive models for soils, Cam-clay model. This course is equivalent to CIVE 5506 at Carleton University.

Course Component: Lecture

CVG 7120 Solid Mechanics (3 units)

Cartesian tensor notation; stresses and strains in a continuum; transformations, invariants; equations of motion; constitutive relations; generalized Hooke's Law, bounds for elastic constant: strain energy, superposition, uniqueness; formulation of plane stress and plane strain problems; energy principles, variational methods; plasticity. This course is equivalent to CIVE 5101 at Carleton University

Course Component: Lecture

CVG 7122 Finite Element Analysis 1 (3 units)

Advanced finite element methods for linear systems. The relationship with variational and Galerkin formulations, system of linear equations, polynomial interpolation, numerical integration, and theory of elasticity is explored. Isoparametric formulations for structural and continuum elements are examined. Introduction to linear dynamics and nonlinear problems. This course is equivalent to CIVE 5103 at Carleton University.
Course Component: Lecture

CVG 7123 Earthquake Analysis and Design of Structures (3 units)

Advanced vibration analysis techniques; Rayleigh-Ritz procedure; subspace iteration; derived Ritz coordinates; proportional and non-proportional damping; introduction to seismology; earthquake response analysis via time and frequency domain; response spectrum approach; multiple input excitations; design considerations and code requirements; other advanced topics in earthquake engineering. This course is equivalent to CIVE 5104 at Carleton University.
Course Component: Lecture

CVG 7124 Finite Element Analysis 2 (3 units)

Variational and Galerkin formulations: assumed displacement, assumed stress and hybrid elements; plate bending: convergence, completeness and conformity, patch test, Kirchhoff and Mindlin plate theories, nonlinear elasticity and plasticity; geometric non-linearity, Eulerian and Lagrangian formulations; incremental and iterative schemes, finite elements in dynamics. This course is equivalent to CIVE 5105 at Carleton University.
Course Component: Lecture

CVG 7126 Advanced Steel Structures (3 units)

Limit states design philosophy; material behavior; tension members; plate buckling; torsion; lateral torsional buckling; beams, axially loaded columns and beam-column behavior; brittle fracture and fatigue; frame stability and second order effects. This course is equivalent to CIVE 5204 at Carleton University.
Course Component: Lecture

CVG 7128 Prestressed Concrete (3 units)

Behavior and analysis of prestressed concrete elements subjected to axial loads, flexure and shear: material properties; prestressing systems; linear and non-linear behavior; deflections; compression-field approaches; disturbed regions; restraint of deformations; design requirements; applications to pressure vessels, bridges and frames. This course is equivalent to CIVE 5206 at Carleton University.
Course Component: Lecture

CVG 7130 Advanced Mechanics of Reinforced Concrete (3 units)

Review of various analytical methods, constitutive models, and failure criteria for reinforced concrete structures; performance assessment and forensic analysis; nonlinear finite element analysis of concrete structures. This course is equivalent to CIVE 5208 at Carleton University.
Course Component: Lecture

CVG 7137 Dynamics of Structures (3 units)

Structural dynamics, single and multi-degree-of-freedom systems, formulation of equations of motion, methods of analytical mechanics, free and forced vibrations, normal mode analysis, numerical methods for the response analyses of single and multiple-degree-of-freedom systems. This course is equivalent to CIVE 5106 at Carleton University.
Course Component: Lecture

CVG 7138 Masonry Behavior and Design (3 units)

Properties of masonry materials and assemblages. Behavior and design of walls, columns and lintels. Treatment of specialized design and construction topics. Design of low rise and high rise structures. Discussion of masonry problems. Emphasis on a practice-oriented approach. This course is equivalent to CIVE 5200 at Carleton University.
Course Component: Laboratory, Lecture

CVG 7151 Traffic Engineering (3 units)

Introduction to principles of traffic engineering. Traffic operation concepts. Travel modes and modal characteristics. Traffic stream characteristics and queuing theory. Capacity and level of service analysis of roads and intersections. Includes: Experiential Learning Activity. This course is equivalent to CIVE 5305 at Carleton University.
Course Component: Lecture

CVG 7153 Urban Transportation (3 units)

Urban transportation systems, planning and management. Introduction to models of urban travel demand. Overview of modern transportation planning issues and policies. The role of transportation planning within the wider context of transportation decision-making. Transportation land use interaction. This course is equivalent to CIVE 5307 at Carleton University.
Course Component: Lecture

CVG 7154 Highway Geometric Design (3 units)

Principles of highway geometric design. Safety and human factors, and their interaction with the road elements. Multimodal considerations. Road design elements. New and evolving concepts. This course is equivalent to CIVE 5308 at Carleton University.
Course Component: Lecture

CVG 7158 Airport Planning (3 units)

Framework for airport planning and design. Aircraft characteristics; demand forecasting; airport site selection; noise, airside capacity; geometric design; the passenger terminal complex; cargo area; general aviation; ground transportation; land use planning. This course is equivalent to CIVE 5403 at Carleton University.
Course Component: Lecture

CVG 7170 Fundamentals of Fire Safety Engineering (3 units)

The fire safety system, including social, economic and environmental issues; description of the fire safety regulatory system and the governing building codes and standards. This includes the global fire safety system in a facility and active fire protection systems; detection, suppression, smoke management. This course is equivalent to CIVE 5609 at Carleton University.
Course Component: Lecture

CVG 7171 Fire Dynamics I (3 units)

Fundamentals of combustion including material and energy balances, chemical thermodynamics, kinetics, premixed and diffusive burning. Advanced topics in the theory of combustion, flame propagation, efficiency of combustion, and the physico-chemical properties of combustible material. This course is equivalent to CIVE 5610 at Carleton University.
Course Component: Lecture

CVG 7172 Fire Dynamics II (3 units)

Fire dynamics from ignition through heat transfer to growth and spread of fires and their suppression. Factors such as containment and its role in the dynamics of fires and explosions are covered. This course is equivalent to CIVE 5613 at Carleton University.
Course Component: Lecture
Prerequisite: CVG 7171.

CVG 7173 People in Fires (3 units)

Review of the work presented by the founders in the field of human behavior in fire. Introduction to the basic notions of perception, cognition, information processing, decision-making and problem solving. Behavioral concepts such as panic, commitment, affiliation, familiarity and role are discussed. This course is equivalent to CIVE 5611 at Carleton University.
Course Component: Lecture

CVG 7174 Fire Modelling (3 units)

Fire modeling and its role in fire safety engineering. Review of the main modeling techniques used in Fire Safety Engineering: network, zone and Computational Fluid Dynamics (CFD). This course is equivalent to CIVE 5612 at Carleton University.
Course Component: Lecture

CVG 7175 Design for Fire Resistance (3 units)

Behavior of materials and structures at elevated temperatures; fire-resistance tests; fire-resistance ratings; building code requirements; real-world fires; assessing the fire resistance of steel, concrete and wood building assemblies. This course is equivalent to CIVE 5614 at Carleton University.
Course Component: Lecture

CVG 7181 Performance-Based Earthquake Engineering (3 units)

Seismic performance assessment of new and existing buildings using modelling. Design and construction of nonlinear structural models. Accounting for mass, material behavior, damping, and nonlinear geometry. Use of pushover and time history analysis methods to determine seismic performance. Consideration of nonstructural elements in determining performance. This course is equivalent to CIVE 5108 at Carleton University.
Course Component: Lecture

CVG 7184 Blast Load Effects on Structures (3 units)

Threats, risk analysis, vulnerability assessment; explosives: types and mechanisms; load determination; response of structural elements under blast loads, analysis and design for blast loads; blast mitigation, retrofit of structures; post-event assessment. This course is equivalent to CIVE 5507 at Carleton University.
Course Component: Lecture

CVG 7185 Topics in Fire Safety (3 units)

Courses in special topics related to fire safety, not covered by other graduate courses. This course is equivalent to CIVE 5810 at Carleton University.
Course Component: Lecture

CVG 7300 Topics in Structures (3 units)

This course is equivalent to CIVE 5705 at Carleton University.
Course Component: Lecture

CVG 7301 Topics in Structures (3 units)

This course is equivalent to CIVE 5706 at Carleton University.
Course Component: Lecture

CVG 7302 Topics in Structures (3 units)

This course is equivalent to CIVE 5707 at Carleton University.
Course Component: Lecture

CVG 7303 Topics in Structures (3 units)

This course is equivalent to CIVE 5708 at Carleton University.
Course Component: Lecture

CVG 7304 Topics in Structures (3 units)

This course is equivalent to CIVE 5709 at Carleton University.
Course Component: Lecture

CVG 7305 Topics in Geotechnique (3 units)

This course is equivalent to CIVE 5800 at Carleton University.
Course Component: Lecture

CVG 7306 Topics in Geotechnique (3 units)

This course is equivalent to CIVE 5801 at Carleton University.
Course Component: Lecture

CVG 7307 Topics in Geotechnique (3 units)

This course is equivalent to CIVE 5802 at Carleton University.
Course Component: Lecture

CVG 7308 Topics in Geotechnique (3 units)

This course is equivalent to CIVE 5803 at Carleton University.
Course Component: Lecture

CVG 7309 Topics in Geotechnique (3 units)

This course is equivalent to CIVE 5804 at Carleton University.
Course Component: Lecture

CVG 7310 Topics in Transportation (3 units)

This course is equivalent to CIVE 5805 at Carleton University.
Course Component: Lecture

CVG 7311 Topics in Transportation (3 units)

This course is equivalent to CIVE 5806 at Carleton University.
Course Component: Lecture

CVG 7312 Topics in Transportation (3 units)

This course is equivalent to CIVE 5807 at Carleton University.
Course Component: Lecture

CVG 7313 Topics in Transportation (3 units)

This course is equivalent to CIVE 5808 at Carleton University.
Course Component: Lecture

CVG 7314 Topics in Transportation (3 units)

This course is equivalent to CIVE 5809 at Carleton University.
Course Component: Lecture

CVG 7315 Topics in Fire Safety (3 units)

This course is equivalent to CIVE 5811 at Carleton University.
Course Component: Lecture

CVG 7316 Topics in Fire Safety (3 units)

This course is equivalent to CIVE 5812 at Carleton University.
Course Component: Lecture

CVG 7317 Topics in Fire Safety (3 units)

This course is equivalent to CIVE 5813 at Carleton University.
Course Component: Lecture

CVG 7318 Topics in Fire Safety (3 units)

This course is equivalent to CIVE 5814 at Carleton University.
Course Component: Lecture

CVG 7337 Energy and the Critical Zone (3 units)

Survey of environmental impacts of energy development including groundwater and soil contamination and greenhouse gas emissions. Application of relevant theory (multiphase flow, mass transfer, fate and transport) to describe key environmental processes, detection, monitoring, and mitigation. Previous contaminant hydrogeology related course knowledge expected. Includes: Experiential Learning Activity. This course is equivalent to ENVE 5207 at Carleton University.
Course Component: Lecture

CVG 8366 Doctoral Seminar in Civil Engineering

Consists of a two-semester seminar course requiring continuous registration until the requirement is met. Each Doctoral student presents once per semester and is expected to attend and participate in all seminar sessions during that semester. No seminars are held during the spring/summer months; however, students who have completed the first seminar semester must continuously register in this activity until the second seminar semester is completed. The seminar requirement must be fulfilled prior to thesis submission.
Course Component: Seminar
Prerequisite: CVG 9998.

CVG 9997 Proposition de doctorat / Ph.D. Proposal

Les étudiants aux études supérieures au niveau du doctorat dans le programme de génie civil doivent réussir une proposition de thèse de doctorat, qui comprend une proposition écrite ainsi qu'une soutenance orale réussie. Les étudiants doivent s'inscrire au trimestre durant lequel ils présenteront leur proposition. / Graduate students at the Doctoral level in the Civil Engineering program are required to successfully complete a Ph.D. Thesis Proposal, which consists of a written proposal and its successful oral defence. Students are required to register in the term they will defend their proposal.
Volet / Course Component: Recherche / Research
Préalable: CVG 9998. Cours concomitant: THD 9999. / Prerequisite: CVG 9998. Corequisite: THD 9999.

CVG 9998 Examen général de doctorat / Comprehensive Examination (Phd)

Volet / Course Component: Recherche / Research