Civil Engineering - Joint (CIVJ)

Civil Engineering - Joint (CIVJ) Courses

CIVJ 5105 [0.5 credit] (CVG 5175)
Numerical Methods for Geotechnical Engineering
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.

CIVJ 5106 [0.5 credit] (CVG 5161)
Mechanics of Unsaturated Soils
Introduction to unsaturated soils, phase properties and relations, stress state variables. Measurement & theory of soil suction, capillarity, permeability, shear strength, failure envelope for unsaturated soils, triaxial and direct shear tests, volume change behaviour.

CIVJ 5109 [0.5 credit] (CVG 5314)
Geotechnical Hazards
Assessment, prevention, and mitigation of geotechnical hazards, Natural and man-made geohazards; 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.

CIVJ 5110 [0.5 credit] (CVG 5187)
Rock Mechanics
Rock exploration, laboratory and in-situ testing, rock mass classification, deformation and strength, failure criteria, stresses in rock, foundations on rock.

CIVJ 5151 [0.5 credit] (CVG 5151)
Advanced Timber Design
Characteristic values for timber and engineered wood products, modification factors used in design; combined bending axial loading; design for bi-axial bending; design of curved glued laminated beams, Timber-Concrete Composite (TCC) floor systems; lateral design (light frame, CLT, hybrid structures); advanced connection design.

CIVJ 5181 [0.5 credit] (CVG 5181)
Decentralized Wastewater Management
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.
Also listed as ENVJ 5302.

CIVJ 5182 [0.5 credit] (CVG 5182)
Water Resources Management
Global water supply and demand, integrated water resources management, modelling and optimization of water resources systems, reservoir management, uncertainty modelling, climate change and water, decision under uncertainty.
Also listed as ENVJ 5182.

CIVJ 5183 [0.5 credit] (CVG 5183)
Mixing and Transport in Water Bodies
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 models, dilution models, three-dimensional models, advection-diffusion equation, analytical/numerical solution, non-conservative transport and multi-component systems.
Also listed as ENVJ 5183.

CIVJ 5184 [0.5 credit] (CVG 5184)
Construction Cost Estimating
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.

CIVJ 5185 [0.5 credit] (CVG 5185)
Construction Life Cycle Analysis
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. Breakeven, sensitivity and risk analysis.

CIVJ 5186 [0.5 credit] (CVG 5186)
Project Information Management
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.

CIVJ 5188 [0.5 credit] (CVG 5188)
Loads on structures
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.

CIVJ 5189 [0.5 credit] (CVG5189)
Blast Engineering
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; blast-resistant building design.

CIVJ 5190 [0.5 credit] (CVG 5190)
Rehabilitation of Concrete Structures
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.
Lecture three hours a week

CIVJ 5191 [0.5 credit] (CVG 5191)
Diagnosis and Prognosis of Concrete Infrastructure
Condition assessment of concrete infrastructure using experimental (i.e. visual, nondestructive, 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 approaches.
Lecture three hours a week

CIVJ 5192 [0.5 credit] (CVG 5192)
Characterization Methods for Materials
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.

CIVJ 5193 [0.5 credit] (CVG 5193)
Instrumentation and Experimental Design for Civil Engineering
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, closed versus open-loop control; servomotor types and servo-valves.

CIVJ 5201 [0.5 credit] (CVG 5142)
Advanced Structural Dynamics
Dynamic behaviour of civil engineering structures under excitations due to earthquakes, wind, waves. Advanced methods in dynamic analysis of structures. Prediction of structural response. Design considerations.

CIVJ 5202 [0.5 credit] (CVG 5143)
Advanced Structural Steel Design
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.

CIVJ 5203 [0.5 credit] (CVG 5145)
Theory of Elasticity
Stress-strain relations. Theories of plane stress and plane strain. Use of stress functions, energy and variational methods in the analysis of elastostatic problems.

CIVJ 5204 [0.5 credit] (CVG 5147)
Theory of Plates and Shells
Stress distribution in flat plates of various shapes. Large deflection theory, numerical methods. Membrane theory, bending theory for cylindrical shells, bending theory for shells of revolution.

CIVJ 5206 [0.5 credit] (CVG 5150)
Advanced Concrete Technology
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.

CIVJ 5207 [0.5 credit] (CVG 5216)
Sustainable and Resilient Infrastructure in Changing Climate
Development of infrastructure with long-term sustainability and resiliency under various extreme events; 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.

CIVJ 5209 [0.5 credit] (CVG 5153)
Wind Engineering
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.

CIVJ 5212 [0.5 credit] (CVG 5212)
Climate Change Impacts on Water Resources
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.
Also listed as ENVJ 5212.

CIVJ 5300 [0.5 credit] (CVG 5144)
Advanced Reinforced Concrete
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.

CIVJ 5301 [0.5 credit] (CVG 5156)
Finite Element Methods I
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.
Precludes additional credit for CIVE 5103.

CIVJ 5302 [0.5 credit] (CVG 5146)
Numerical Methods of Structural Analysis
Numerical procedures and methods of successive approximations for the solution of structural problems. Virtual work, principles of minimum potential and complementary energy. Applications of variation and finite difference techniques to the solutions of complicated problems in beams, plates and shells.

CIVJ 5303 [0.5 credit] (CVG 5157)
Finite Element Methods II
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. Precludes additional credit for CIVE 5105.

CIVJ 5304 [0.5 credit] (CVG 5149)
Structural Stability
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.

CIVJ 5305 [0.5 credit] (CVG 5148)
Prestressed Concrete Design
Materials, methods of prestressing, prestress losses, and anchorage zone stresses. Elastic analysis, design and behaviour of simple and continuous prestressed concrete beams, frames and slabs. Discussion of current design specifications. Ultimate strength of members.

CIVJ 5306 [0.5 credit] (CVG 5155)
Earthquake Engineering
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.

CIVJ 5307 [0.5 credit] (CVG 5158)
Elements of Bridge Engineering
Introduction; limit state design; highway bridge design loads; analysis and design of concrete decks; impact and dynamics; load capacity rating of existing bridges and construction in cold climate.

CIVJ 5308 [0.5 credit] (CVG 5154)
Random Vibrations
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.

CIVJ 5309 [0.5 credit] (CVG 5159)
Long Span Structures
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.
Includes: Experiential Learning Activity

CIVJ 5310 [0.5 credit] (CVG 5311)
Bridge Design
Design of highway bridges, Canadian Highway Bridge Design Code (CHBDC). Comparisons with other bridge codes (AASHTO, the European, the New Zealand, and the British). Structural components of highway bridges, types of highway bridges, serviceability and ultimate limit state design requirements, design loads.

CIVJ 5311 [0.5 credit] (CVG 5312)
Durability of Concrete Structures
Properties of cementitious materials (constituents of concrete, hydration of cement, structure of hardened concrete, transport processes in concrete); deterioration of concrete (built-in problems, construction defects, cracking, dimensional stability, alkali-aggregate reaction, sulphate attack, corrosion of reinforcing steel, freezing-thawing cycles); evaluation of concrete structures.

CIVJ 5312 [0.5 credit] (CVG 5313)
Seismic Analysis and Design of Concrete Structures
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 (FEM and fiber modeling), performance-based earthquake engineering and displacement-based design.
Includes: Experiential Learning Activity

CIVJ 5333 [0.5 credit] (CVG 5333)
Research Methodology
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.
Also listed as ENVJ 5333.

CIVJ 5501 [0.5 credit] (CVG 5111)
Hydraulic Structures
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. channel design.

CIVJ 5502 [0.5 credit] (CVG 5112)
Computational Hydrodynamics
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, methods for tracking free surfaces.

CIVJ 5503 [0.5 credit] (CVG 5160)
Sediment Transport
Introduction to particle transport with 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.

CIVJ 5504 [0.5 credit] (CVG 5162)
River Hydraulics
Advanced concepts of river hydraulics, with an emphasis on field measurement techniques and application of numerical models. Navier-Stokes equations, turbulence, flow resistance, numerical modeling of simplified momentum and continuity equations, field-based measurement and statistical analysis of velocity fields. Special topics include contaminant transport, morphodynamic modeling.

CIVJ 5605 [0.5 credit] (CVG 5124)
Coastal Engineering
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).

CIVJ 6000 [0.5 credit] (CVG 6300)
Special Topics in Civil Engineering

CIVJ 6001 [0.5 credit] (CVG 6301)
Special Topics in Civil Engineering

CIVJ 6002 [0.5 credit] (CVG 6302)
Special Topics in Civil Engineering

CIVJ 6003 [0.5 credit] (CVG 6303)
Special Topics in Civil Engineering

CIVJ 6004 [0.5 credit] (CVG 6304)
Special Topics in Civil Engineering

CIVJ 6005 [0.5 credit] (CVG 6305)
Special Topics in Civil Engineering

CIVJ 6006 [0.5 credit] (CVG 6306)
Special Topics in Civil Engineering

CIVJ 6007 [0.5 credit] (CVG 6307)
Special Topics in Civil Engineering

CIVJ 6008 [0.5 credit] (CVG 6308)
Special Topics in Civil Engineering

CIVJ 6009 [0.5 credit] (CVG 6309)
Special Topics in Civil Engineering

CIVJ 6010 [0.5 credit] (CVG 6310)
Special Topics in Civil Engineering

CIVJ 6011 [0.5 credit] (CVG 6311)
Special Topics in Civil Engineering

CIVJ 6012 [0.5 credit] (CVG 6312)
Special Topics in Civil Engineering

CIVJ 6013 [0.5 credit] (CVG 6313)
Special Topics in Civil Engineering

CIVJ 6014 [0.5 credit] (CVG 6314)
Special Topics in Civil Engineering

CIVJ 6015 [0.5 credit] (CVG 6315)
Special Topics in Civil Engineering

CIVJ 6016 [0.5 credit] (CVG 6316)
Special Topics in Civil Engineering

CIVJ 6017 [0.5 credit] (CVG 6317)
Special Topics in Civil Engineering

CIVJ 6018 [0.5 credit] (CVG 6318)
Special Topics in Civil Engineering

CIVJ 6019 [0.5 credit] (CVG 6019)
Special Topics in Civil Engineering

CIVJ 6020 [0.5 credit] (CVG 6320)
Special Topics in Civil Engineering