



***CIVIL ENGINEERING***  
***SYLLABUS OF EXAMINATIONS***  
**1998 EDITION**

For textbook information please refer to the **Textbooks** section on page 3 of the document entitled **Information for Students and Examinations Candidates**.

**GROUP A**  
**COMPULSORY EXAMINATIONS (six required)**

**98-Civ-A1 Elementary Structural Analysis**

Computation of reactions, shearing forces, normal forces, bending moments, and deformations in determinate structures. Influence lines for moving loads. Moment distribution, slope deflection, and energy methods for indeterminate structures without sidesway.

**98-Civ-A2 Elementary Structural Design**

Limit states design concepts. Loading due to use and occupancy, snow, wind, and earthquake. Design of tension members, beams, and columns in timber and steel. Design of timber connections and simple welded and bolted connections in steel. Design of determinate reinforced concrete beams and columns.

**98-Civ-A3 Environmental Engineering**

Population, economic growth, industrialization, urbanization and energy-use, as causes of environmental pollution.

The characteristics of particles, chemistry of solutions and gases, material balances, reaction kinetics, microbiology and ecology, as related to the environment.

The application of environmental principles (technical and non-technical) to: water resource management, water and wastewater treatment, air pollution control, solid waste management, environmental impact assessment, sustainable development and environmental ethics.

**98-Civ-A4 Geotechnical Materials and Analysis**

Materials: Origin of soils, soil identification and classification. Compaction. Permeability, pore water pressure and effective stress. Compressibility and consolidation. Shear strength, stress paths, and critical states. Frost action. Associated laboratory tests.

Analysis: Elastic stress distribution, settlements, times of settlements. Introductory analysis of lateral earth pressures, bearing capacity, and slopes. Seepage; well flow and confined 2-D flow problems.

### **98-Civ-A5    Hydraulic Engineering**

Dimensional analysis and hydraulic models. Application of continuity, momentum and energy principles. Steady, closed conduit flow in single pipes and pipe networks. Steady, open-channel flow under uniform and gradually varied conditions, control sections, hydraulic jumps, and energy dissipaters. Hydraulic transients; surges and water hammer in closed conduits, surface waves in open channels. Concepts and principles of turbo machinery, especially centrifugal pumps; similarity relations and cavitation; operation of pump-and-pipe systems.

Introductory concepts of hydraulic structures, including environmental aspects of hydraulic works and water quality management.

### **98-Civ-A6    Transportation Planning and Engineering**

Socio-economic impacts on transportation, demand modelling. Characteristics of transportation systems; rail, road, air, water, and pipelines. Transportation systems in Canada. Characteristics of traffic flow, queuing theory, capacity analysis, space-time diagrams. Urban traffic management, traffic signals, pedestrians, accidents. Intelligent transportation systems.

## **GROUP B**

### **ELECTIVE EXAMINATIONS (three required)**

#### **98-Civ-B1    Advanced Structural Analysis**

Analysis of statically indeterminate structures, including trusses, beams, frames, and arches. Formulation of flexibility (force) and stiffness (displacement) methods of analysis. Introductory finite element analysis.

#### **98-Civ-B2    Advanced Structural Design**

Limit states design of steel members and connections in continuous framing; of slabs and footings in reinforced concrete, of pre-stressed concrete members and assemblies; and of composite steel-concrete construction. Influence of creep and shrinkage in concrete construction.

#### ***Code***

Applicable Portions of the National Building Code of Canada and reference CSA Standards (current editions).

#### **98-Civ-B3    Geotechnical Design**

Characterization of natural deposits, subsurface investigation, and field measurements. Design procedures for settlement and stability of shallow and deep foundation systems in soil and rock. Design of excavations and retaining structures; slopes and embankments. Geoenvironmental design topics covering seepage through dams and landfills and the control of seepage through the use of filters and low permeability layers including the use of geosynthetic liners and filters. Mechanically stabilized (MSE) walls and slopes.

#### **98-Civ-B4    Engineering Hydrology**

Hydrologic processes: precipitation and snow melt, infiltration, evaporation and evapotranspiration, ground-water flow, runoff. Point and area estimates of precipitation. Stream flow measurement. Runoff hydrographs, unit hydrographs, conceptual models of runoff, and

basics of hydrologic modeling. Channel system: reservoir and lake routing, channel routing and flood wave behavior Statistical methods: frequency and probability with application to precipitation, floods, and droughts.

Urban and highway drainage structure design.

#### **98-Civ-B5 Water Supply and Wastewater Treatment**

Physical, chemical, and microbiological characteristics of water and wastewater. Regulation of water quality for supply and discharge, elements of receiving water characterization and specification of effluent limits. Elements of water and wastewater treatment including, coagulation, flocculation, filtration, settling, softening, disinfection, fluoridation, taste and odour control and biological processes. Sludge disposal.

Quantity and quality estimation of water and wastewater. Water storage and distribution systems. Wastewater collection systems.

#### **98-Civ-B6 Urban and Regional Planning**

The context of urban planning; basic planning studies, including population, economic, and land-use studies. The strategy, development, and engineering associated with comprehensive plans and full infrastructure development including housing, industry, transportation, recreation, water and sewerage, social service components. The use of analytical procedures and data systems. Plan implementation measures and controls, including zoning, land subdivision, and urban renewal. The role of the planner in directing and monitoring urban and regional development.

#### **98-Civ-B7 Highway Design, Construction, and Maintenance**

Route surveying. Geometric design, including horizontal and vertical alignment and intersections. Properties of road-making materials. Asphalt mix design. Structural design for flexible and concrete pavements. Earthworks and drainage. Pavement management, including condition evaluation, maintenance, and rehabilitation.

#### **98-Civ-B8 Management of Construction**

Size and structure of Canadian design and construction sectors. Methods of project delivery, project management, and organizational form. Site investigation. Estimating and bidding, project planning, scheduling and control, activity planning. Safety practices and regulations, insurance, quality assurance and control. Labour relations. Contract administration. Litigation.

#### **98-Civ-B9 Civil Engineering Analysis and the Finite Element Method**

Introduction to discretization techniques for solving Civil Engineering problems. The finite element method including; derivation of element and global force-displacement equations employing both the variational and direct stiffness methods, criteria for selection of approximating functions, available finite elements, general constitutive relations, substructure analysis and constraint equations, numerical methods of solution. Finite element applications to structural, geotechnical, and hydraulic engineering analysis.

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