

## INTRODUCTION

The Canadian Engineering Qualifications Board of Engineers Canada issues the Examination Syllabus that includes a continually increasing number of engineering disciplines.

Each discipline examination syllabus is divided into two examination categories: compulsory and elective. A full set of Building Engineering examinations consists of ten, three-hour examination papers. Candidates will be assigned examinations based on an assessment of their academic background. Examinations from discipline syllabi other than those specific to the candidates' discipline may be assigned at the discretion of the constituent Association/Ordre.

Before writing the discipline examinations, candidates must have passed, or have been exempted from, the Basic Studies Examinations.

The constituent members will supply information on examination scheduling, textbooks, materials provided or required, and whether the examinations are open or closed book.

## BUILDING ENGINEERING EXAMINATIONS

### GROUP A

#### COMPULSORY EXAMINATIONS (SEVEN REQUIRED)

##### 07-Bld-A1 Elementary Structural Analysis

**Structural Analysis I:** Analysis of statically determinate structures: deflections, strain energy concepts, virtual work principles. Mueller Breslau principle, influence lines. Approximate methods for statically indeterminate structures. Collapse load analysis.

**Structural Analysis II:** Analysis of statically indeterminate structures: the methods of consistent deformations, slope deflection, and moment distribution. Application of virtual work principles. Introduction to matrix methods.

##### 07-Bld-A2 Elementary Structural Design

**Structural Design I:** Basis for limit states design. Code requirements. Structural steel design: tension and compression members, beams and beam-columns. Connections. Introduction to the design of timber members.

**Structural Design II:** Reinforced concrete behaviour in flexure, compression, shear, and bond. Ultimate strength design of reinforced concrete beams, columns, walls, and footings. Introduction to prestressed concrete and masonry.

##### 07-Bld-A3 Construction Engineering

**Construction Engineering:** The nature of construction and the environment in which the industry works; organizational structures for project delivery; construction contracts and documents; introduction to construction processes: excavation and site works, foundation layout, concrete form design, concrete, steel, timber, and masonry construction; project planning, scheduling, and control; construction safety.

**Project Management for Construction:** Introduction to project management techniques in construction, including project delivery methods, construction contracts, cost estimating and bidding planning and scheduling, cash flow analysis, project tracking and control.

**Labour and Industrial Relations in Construction:** The study of labour legislation with special emphasis on the construction industry, union organization, the theory and practice of negotiations, mediation, contract administration, and arbitration. Review of actual contracts.

**Construction Processes:** A study of current construction methods and techniques. The subjects include site preparation and earthwork, wood framing, masonry, concrete forming, slip forming, precast construction, industrialized building, deep excavation shoring and underpinning. Design, erection, and removal of temporary construction work. Current field practice and safety considerations.

#### **07-Bld-A4 Building Engineering Systems**

**Building Engineering Systems:** Introduction to systematic solution of building engineering problems. Techniques treated include linear programming, network analysis, nonlinear programming. Introduction to decision analysis and simulation. Application of optimization methods for solution of design problems in building science, building environment, building structures, and construction management.

**HVAC System Design:** Principles of HVAC system design and analysis; component and system selection criteria including room air distribution, fans and air circulation, humidifying and dehumidifying processes, piping and ducting design. Air quality standards. Control systems and techniques; operational economics.

**Thermal Analysis of Buildings:** Two- and three-dimensional steady-state and transient conductive heat transfer together with convection and radiation as applied to building materials and geometries. Heating and cooling load analysis, including building shapes, construction type, solar radiation, infiltration, occupancy effects, and daily load variations. Applications for thermal load analysis. Introduction to heat exchangers.

**Building Acoustics:** Noise control criteria and regulations, instrumentation, noise sources, room acoustics, walls, barriers and enclosures, acoustical materials and structures, vibration and noise control systems for buildings.

**Building Illumination:** Production, measurement and control of light, design of lighting systems. Design in respect to daylighting. Integration of lighting systems with mechanical systems.

#### **07-Bld-A5 Building Science**

**Building Science:** General introduction to the thermal environment. Topics include heat, temperature, one-dimensional steady-state processes. Convection: natural and forced. Radiation. Combined radiative and convective surface transfer. Psychrometrics. Thermal comfort. Air quality. Condensation: surface and interstitial. Introduction to compressible viscous flow, friction, and flow in pipes; boundary layer and wind effects.

#### **07-Bld-A6 Geotechnical Materials and Analysis**

**Soil Mechanics:** Index properties and classification of soils. Weight-volume relationships. Soil structures. Moisture-density relationships. Permeability, deformation, and strength of soils. Principle of total and effective stresses. Steady state seepage through isotropic soil media. Stress distribution due to external loads and analysis of total settlements. Outline of theory of consolidation. Fundamentals of stability of earth retaining walls, slopes, and footings.

## **07-Bld-A7 Building Envelope Design**

**Building Envelope Design:** Technical influences in the design of building envelope, including the control of heat flow, air and moisture penetration, building movements, and deterioration. Application of air/vapour barrier and rain-screen systems. Performance assessment and building codes through case studies and design projects. Design of walls, roofs, joints and assemblies. Cause of deterioration and preventive measures, on-site investigation. Relevant building codes and standards.

## GROUP B

### ELECTIVE EXAMINATIONS (THREE REQUIRED)

#### 07-BId-B1 Computer Programming

**Construction Information Systems:** Information technology and information management in construction. Resolution of technical problems by means of software (spreadsheets, data bases, etc.). Programming with Visual Basic. AutoCAD. 3D Modelling.

#### 07-BId-B2 Advanced Structural Analysis

**Introduction to Structural Dynamics:** Theory of vibration. Dynamic response of simple structural systems. Effects of blast, wind, traffic, and machinery vibrations. Basic concepts in earthquake resistant design. Computer applications. Lectures: three hours per week.

**Matrix Analysis of Structures:** Classical and matrix methods of structural analysis; influence coefficients, transformation matrices. Matrix formulation of the force and of the displacement methods of analysis. Direct stiffness approach; substructure technique. Introduction to finite-element method. Computer applications.

#### 07-BId-B3 Advanced Structural Design

**Foundation Design:** Loads, bearing capacity, and settlement. Lateral pressures. Foundation drainage and water-proofing. Spread footings. Strip footings. Pile foundations. Caissons. Retaining walls. Sheet-piling walls. Braced cofferdams. Cellular cofferdams. Anchors.

**Design of Reinforced Concrete Structures:** Design of long columns, columns subjected to biaxial bending, two-way slabs, flat plates, girders, and shells. Design of frames, shear-walls, and prefabricated structures. Prestressed concrete: losses, short- and long-term deflections; design requirements for shear, flexure, bond, and anchorage

**Design of Steel Structures:** Trends and developments in structural-steel design. Framing systems. Floor systems; composite construction; plate girders. Design of braced frames, moment-resisting frames. Connections. P-Delta effects. Introduction to steel-bridge design.

#### 07-BId-B4 Modern Building Materials

**Modern Building Materials** Engineering properties of building materials such as: plastics, synthetic fibres, adhesives, sealants, caulking compounds, foams, sandwich panels, composites, polymer concrete systems, fibre-reinforced concretes, plastic mortars, polymers for flooring, roofing, synthetic wall papers. Moisture properties of modern building materials. Their structural, thermal, and acoustical properties. Consideration of corrosion, bio- and thermal-degradation, stability to ultraviolet and solar radiation.

#### 07-BId-B5 Fire and Smoke Control in Buildings

**Fire and Smoke Control in Buildings:** Topics treated include fire and smoke control; failure mechanisms of building enclosure illustrated by case studies; code requirements for enclosure systems; systems approach for fire safety.

### **07-Bld-B6 Building Energy Conservation Technologies**

**Building Energy Conservation Technologies:** Standards of energy efficiency in buildings. Trends in energy consumption. Energy audit: evaluation of energy performance of existing buildings, weather normalization methods, measurements, disaggregation of total energy consumption, use of computer models, impact of people behaviour. Energy efficiency measures in buildings: approaches, materials and equipments, operating strategies, evaluation methods of energy savings. Renewable energy sources: passive or active solar systems, geothermal systems, free-cooling. Optimum selection of energy sources. Air-to-air energy recovery.

### **07-Bld-B7 Indoor Air Quality**

**Indoor Air Quality:** Elements of indoor air quality, physical/ chemical characteristics of contaminants, health effects, standard requirements. Estimation of the levels of indoor air contaminants in buildings. Design of ventilation systems for pollutant control. Air pollution due to outdoor air supply through ventilation systems. Effect of outdoor air pollution on indoor air quality.

### **07-Bld- B8 Control Systems in Buildings**

**Control Systems in Buildings:** Introduction to automatic control systems. Control issues related to energy conservation, indoor air quality and thermal comfort in buildings, ventilation. Classification of HVAC control systems. Control system hardware: selection and sizing of sensors, actuators and controllers. Practical HVAC control systems; elementary local loop and complete control systems. Designing and tuning of controllers. Building automation systems.

### **07-Bld-B9 Building Services**

**Acoustics and Lighting:** General introduction to the aural and visual environment. Psychological impact of environment. Subjective and objective scales of measurement. Introduction to vibration. The hearing mechanism. Transmission of sound, passive control of noise in buildings, transmission loss, absorption and reverberation time. Room acoustic assessment. Active control of the aural environment. Visual perception. Photometry, brightness, luminance, and illumination. Concept of natural lighting in building. Artificial lighting; light sources; luminaries. Calorimetry. Calculation methods for artificial lighting.

**Building Service Systems:** Principles of building service systems, including electrical, gas, communications, service-water supply and distribution; introduction to plans, codes, and standards for utility distribution systems.