

TOTAL EXAMINATION PROGRAM

PEO Syllabus of Examinations, 2004 Edition

STRUCTURAL ENGINEERING

PROFESSIONAL EXAMS – SPECIFIC TO STRUCTURAL ENGINEERING

GROUP A

GROUP A

07-STR-A1 = 16-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.

07-STR-A2 = 16-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.

07-STR-A3 = 16-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.

07-STR-A4 Advanced Structural Analysis (16-CIV-B1)

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

WRITTEN SLIGHTLY DIFFERENT THAN 16-CIV-B1 BUT SAME EXAM.

07-STR-A5 = 16-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.

Select ONE from:

07-STR-A6-1 = 07-STR-B3 Applications of Finite Elements (16-CIV-B9)

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. **WRITTEN SLIGHTLY DIFFERENT THAN 16-CIV-B9 BUT SAME EXAM.**

07-STR-A6-2 = 07-STR-B9 Advanced Structural Mechanics

Stress and equilibrium conditions, strain and compatibility conditions, stress-strain relations and yield/failure criteria are considered in the context of civil engineering materials. Two-and three-dimensional elasticity theory is developed, with an introduction to the use of tensor notation. Advanced topics in bending, shear and torsion of beams are also covered, as is elementary plate bending theory. Energy methods including virtual work, potential energy, strain energy, and related approaches. Importance of dynamic loads in the design of structures.

07-STR-A6-3 = 07-STR-B10 Earthquake Engineering (16-CIV-B22)

Structural dynamics related to practical analysis of earthquake-resisting structures. Analysis of single-degree systems include: free vibration, response to time-dependent forces, response to earthquake support motions, response spectra, hysteresis models, and computation of inelastic response. Concepts of energy dissipation, ductility, and inelastic displacement demands. Multi-degree building systems. Earthquake design provisions in national codes including: design loads, and special provisions for earthquake-resisting reinforced concrete and structural steel systems and members.

GROUP B

07-STR-B1 = 16-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.

07-STR-B2 = 16-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.

07-STR-B3 Applications of Finite Elements (16-CIV-B9)

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.

07-STR-B4 Structural Materials

Linear and nonlinear material behavior, time-dependent behavior; structural and engineering properties of structural metals; behavior of wood; production and properties of concrete; bituminous materials, ceramics, plastics; advanced composite materials; cements and aggregates: types, chemistry, microstructure.

07-STR-B5 Foundation Engineering (16-CIV-B19)

Design of spread footings, rafts and pile foundations according to modern professional practice. Procedures for estimation of bearing capacity and settlements, both immediate and long term, design of structures associated with foundation excavations, drainage and site developments such as braced cuts, retaining walls and anchored sheet pile bulkheads. The role of geological history, penetration testing and simple index properties in prediction of foundation performance.

07-STR-B6 Building Engineering and Services (16-CIV-B20)

Functioning of the building enclosure: demonstration of the behaviour of building elements and their sub-assemblies under differential temperature and pressure stresses; fundamentals of acoustics; nature and use of building materials; response of building materials to climatic cycles, radiation, precipitation, heating and cooling; principles of building service systems, including electrical, gas, communications, service-water supply and distribution; introduction to plans, codes, and standards for utility distribution systems.

07-STR-B7 Forensic Engineering and Rehabilitation (20-CIV-B23)

Mechanisms of degradation of structures and forensic assessment of deteriorated structures; structural health monitoring and non-destructive evaluation of structures; repair strategies for deteriorated structures; designing stabilizing and strengthening techniques for structural elements.

07-STR-B8 Architectural Design and Engineering

The range of requirements that drive a building's design including architecture, engineering, constructability, building codes, and budget. The influence of technology, energy conservation, and environmental constraints on built form. Integration of structural and mechanical systems into building types including residential, office, commercial, and retail.

07-STR-B9 Advanced Structural Mechanics (07-STR-A6-2)

Stress and equilibrium conditions, strain and compatibility conditions, stress-strain relations and yield/failure criteria are considered in the context of civil engineering materials. Two- and three-dimensional elasticity theory is developed, with an introduction to the use of tensor notation. Advanced topics in bending, shear and torsion of beams are also covered, as is elementary plate bending theory. Energy methods including virtual work, potential energy, strain energy, and related approaches. Importance of dynamic loads in the design of structures.

07-STR-B10 Earthquake Engineering (07-STR-A6-3)

Structural dynamics related to practical analysis of earthquake-resisting structures. Analysis of single-degree systems include: free vibration, response to time-dependent forces, response to earthquake support motions, response spectra, hysteresis models, and computation of inelastic response. Concepts of energy dissipation, ductility, and inelastic displacement demands. Multi-degree building systems. Earthquake design provisions in national codes including: design loads, and special provisions for earthquake-resisting reinforced concrete and structural steel systems and members.

07-STR-B11 = 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.

Structural Engineering – Suggested Text Listings - 2007

07-Str-A1, Elementary Structural Analysis

Aslam Kassimali, Structural Analysis PWS Publishers Latest Edition ISBN # 0534950469

07-Str-A2, Elementary Structural Design

Handbook of Steel Construction, Current Edition, Canadian Institute of Steel Construction

Concrete Design Handbook, Current Edition, Canadian Portland Cement Association

Wood Design Manual, Current Edition, Canadian Wood Council, Ottawa Tel: 613-247-7077

07-Str-A3, Geotechnical Materials and Analysis

R.F. Craig, Soil Mechanics, 5th Edition, Chapman Hall

B.J. Das, Principles of Geotechnical Engineering, 4th Edition, PWS-Kent

07-Str-A4, Advanced Structural Analysis

Ghali & A.M. Neville, Structural Analysis, Chapman & Hall, 4th Edition, John Wiley & Sons, New York, 1998 (edited by Garas & Virdi).

07-Str-A5, Advanced Structural Design

G.L. Kulak & M.I. Gilmore, Limit States Design in Structural Steel, 6th Edition, Canadian Institute of Steel Construction, 1998

Michel Bruneau, Chia-Ming Uang, Andrew Stuart Whittaker, Ductile Design of Steel Structures – McGraw Hill Co. 1998

Edward G. Nawy, Prestressed Concrete: A Fundamental Approach, 5th edition, Prentice Hall, 2005

C.K. Wang et al, Reinforced Concrete Design, 6th Edition, Harper and Row, 1998

Handbook of Steel Construction, 7th Edition, Canadian Institute of Steel Construction, 1997

07-Str-A6-3, Earthquake Engineering

Dynamics of structures: theory and applications to earthquake engineering, by Anil K. Chopra. Englewood Cliffs, N.J., Prentice Hall, 1995.

Concrete Design Handbook

Steel Design Handbook

07-Str-B1, Geotechnical Design

B.M. Das, Principles of Geotechnical Engineering 4th edition ITP Nelson 1998 ISBN # 0-534-95179-1 (1-800-268-2222)

B.M. Das, Principles of Foundation Engineering 3rd Edition ITP Nelson 1995 ISBN # 0-534-20646-8 (1-800-268-2222)

R.F. Craig, Soil Mechanics, 5th or 6th Edition, Van Nostrand Reinhold (U.K.) Co. Ltd. Nelson Canada - ISBN # 0-412-39590-8 note both out of print

E.A. McBean, F.A. Rovers, G.J. Farquhar, Solid Waste Landfill Engineering and Design Prentice Hall PTR, 1995, ISBN 0-13-079187-3, Chapter 9, Chapter 10

R.M. Koerner, Designing with Geosynthetics, 3rd edition, Prentice Hall, 1994, ISBN 0-13-847823-6, Section 2.8 and chapters 5 and 6.

07-Str-B2, Management of Construction

Donald S. Barrie and Boyd C. Paulson Jr., Professional Construction Management, McGraw-Hill, 1991, ISBN # 0070038899

Ontario Health and Safety Act, Ontario Regulation 213/91 (Construction Projects), Queen's Printing of Ontario, May 10, 1991. The provincial legislation is quite similar in all provinces. The candidate should obtain the Health and Safety Act of their province for study.

Structural Engineering – Suggested Text Listings - 2007

07-Str-B3, Applications of Finite Elements

R.D. Cook, D.S. Malkus, & M.E. Plasha, Concepts and Applications of Element Analysis, 3rd Ed., John Wiley & Sons, ISBN # 0-471-84788-7

07-Str-B5, Foundation Engineering

Braja Das, Principles of Foundation Engineering, 6th Edition, Thomson, ISBN-13: 978-0-495-08246-0

07-Str-B6 Building Engineering and Services

Building Services Engineering by David V Chadderton, 6th edition, published by Routledge

07-Str-B8, Architectural Design and Engineering

A Handbook on Low Energy Buildings and District Energy Systems by Harvey... **Publisher:** Routledge (Aug. 1 2006)

ISBN-10: 1844072436, **ISBN-13:** 978-1844072439

Building Science for Building Enclosures by Straube and Burnett.

alternatively: High Performance Building Envelopes, also by John Straube, can be ordered from

<https://buildingscience.com/bookstore/books/high-performance-enclosures>

Designing the Exterior Wall: An Architectural Guide to the Vertical Envelope, by Linda Brock (2005, Wiley)

07-Str-B10, Earthquake Engineering

Dynamics of structures: theory and applications to earthquake engineering, by Anil K. Chopra. Englewood Cliffs, N.J., Prentice Hall, 1995.

Concrete Design Handbook

Steel Design Handbook

07-Str-B11, Hydraulic Engineering

R.L. Daugherty, J.B. Franzini and E.J. Finnermore, Fluid Mechanics with Engineering Applications, 8th Edition, McGraw-Hill, 1985 (omit chapters 5, 9, 16, and 17)

A suitable alternate text is:

V.L. Streeter, E.B. Wylie, Fluid Mechanics, SI Edition, McGraw-Hill, 1981 (omit chapter 6 on compressible flow) Note there may be a more recent version of this text if there is please use the latest edition.

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