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Principles and Practice of Engineering
CIVIL BREADTH and STRUCTURAL DEPTH Exam Specifications
Effective Beginning with the April 2008 Examinations

- The civil exam is a breadth and depth examination. This means that examinees work the breadth (AM) exam and one of the five depth (PM) exams.
- The five areas covered in the civil examination are construction, geotechnical, structural, transportation, and water resources and environmental. The breadth exam contains questions from all five areas of civil engineering. The depth exams focus more closely on a single area of practice in civil engineering.
- Examinees work all questions in the morning session and all questions in the afternoon module they have chosen.
- The exam is an 8-hour open-book exam. It contains 40 multiple-choice questions in the 4-hour AM session, and 40 multiple-choice questions in the 4-hour PM session.
- The exam uses both the International System of Units (SI) and the US Customary System (USCS).
- The exam is developed with questions that will require a variety of approaches and methodologies, including design, analysis, and application. Some problems may require knowledge of engineering economics.
- The knowledge areas specified as examples of kinds of knowledge are not exclusive or exhaustive categories.

CIVIL BREADTH Exam Specifications

		Approximate Percentage of AM Exam
I.	**Construction**	**20%**

A. Earthwork Construction and Layout
   1. Excavation and embankment (cut and fill)
   2. Borrow pit volumes
   3. Site layout and control

B. Estimating Quantities and Costs
   1. Quantity take-off methods
   2. Cost estimating

C. Scheduling
   1. Construction sequencing
   2. Resource scheduling
   3. Time-cost trade-off

D. Material Quality Control and Production
   1. Material testing (e.g., concrete, soil, asphalt)

E. Temporary Structures
   1. Construction loads

II. Geotechnical 20%

A. Subsurface Exploration and Sampling
   1. Soil classification
   2. Boring log interpretation (e.g., soil profile)

B. Engineering Properties of Soils and Materials
   1. Permeability
   2. Pavement design criteria

C. Soil Mechanics Analysis
   1. Pressure distribution
   2. Lateral earth pressure
   3. Consolidation
   4. Compaction
   5. Effective and total stresses

D. Earth Structures
   1. Slope stability
   2. Slabs-on-grade

E. Shallow Foundations
   1. Bearing capacity
   2. Settlement

F. Earth Retaining Structures
   1. Gravity walls
   2. Cantilever walls
   3. Stability analysis
   4. Braced and anchored excavations

III. Structural 20%

A. Loadings
   1. Dead loads
   2. Live loads
   3. Construction loads

B. Analysis
   1. Determinate analysis

C. Mechanics of Materials
   1. Shear diagrams
   2. Moment diagrams
   3. Flexure
   4. Shear
   5. Tension
   6. Compression
   7. Combined stresses
   8. Deflection

D. Materials
   1. Concrete (plain, reinforced)
   2. Structural steel (structural, light gage, reinforcing)

E. Member Design
   1. Beams
   2. Slabs
   3. Footings

IV. Transportation 20%

A. Geometric Design
   1. Horizontal curves
   2. Vertical curves
   3. Sight distance
   4. Superelevation
   5. Vertical and/or horizontal clearances
   6. Acceleration and deceleration

V. Water Resources and Environmental 20%

A. Hydraulics – Closed Conduit
   1. Energy and/or continuity equation (e.g., Bernoulli)
   2. Pressure conduit (e.g., single pipe, force mains)
   3. Closed pipe flow equations including Hazen-Williams, Darcy-Weisbach Equation
   4. Friction and/or minor losses
   5. Pipe network analysis (e.g., pipeline design, branch networks, loop networks)
   6. Pump application and analysis

B. Hydraulics – Open Channel
   1. Open-channel flow (e.g., Manning's equation)
   2. Culvert design
   3. Spillway capacity
   4. Energy dissipation (e.g., hydraulic jump, velocity control)
   5. Stormwater collection (e.g., stormwater inlets, gutter flow, street flow, storm sewer pipes)
   6. Flood plains/floodways
   7. Flow measurement – open channel

C. Hydrology
   1. Storm characterization (e.g., rainfall measurement and distribution)
   2. Storm frequency
   3. Hydrographs application
   4. Rainfall intensity, duration, and frequency (IDF) curves
   5. Time of concentration
   6. Runoff analysis including Rational and SCS methods
   7. Erosion
   8. Detention/retention ponds

D. Wastewater Treatment
   1. Collection systems (e.g., lift stations, sewer networks, infiltration, inflow)

E. Water Treatment
   1. Hydraulic loading
   2. Distribution systems

CIVIL–STRUCTURAL DEPTH Exam Specifications

		Approximate Percentage of PM Exam
I.	**Loadings**	**12.5%**
	A. Dead loads B. Live loads C. Construction loads D. Wind loads E. Earthquake loads, including liquefaction, site characterization, and pseudo-static analysis F. Moving loads G. Snow loads H. Impact loads I. Load paths J. Load combinations	
II.	**Analysis**	**12.5%**
	A. Determinate analysis B. Indeterminate analysis	
III.	**Mechanics of Materials**	**12.5%**
	A. Shear diagrams B. Moment diagrams C. Flexure D. Shear E. Tension F. Compression G. Combined stresses H. Deflection I. Progressive collapse J. Torsion K. Buckling L. Fatigue M. Thermal deformation	
IV.	**Materials**	**12.5%**
	A. Concrete (plain, reinforced) B. Concrete (prestressed, post-tension) C. Structural steel (structural, light gage, reinforcing) D. Timber E. Masonry (brick veneer, CMU) F. Composite construction	

V. Member Design — 25%

A. Beams
B. Slabs
C. Footings
D. Columns
E. Trusses
F. Braces
G. Frames
H. Connections (bolted, welded, embedded, anchored)
I. Shear walls
J. Diaphragms (horizontal, vertical, flexible, rigid)
K. Bearing walls

VI. Design Criteria — 12.5%

A. International Building Code (IBC)
B. American Concrete Institute (ACI-318, 530)
C. Precast/Prestressed Concrete Institute (PCI Design Handbook)
D. Manual of Steel Construction (AISC) including AISC 341
E. National Design Specification for Wood Construction (NDS)
F. Standard Specifications for Highway Bridges (AASHTO)
G. American Society of Civil Engineers (ASCE-7)
H. American Welding Society (AWS D1.1, D1.2, and D1.4)

VII. Other Topics — 12.5%

A. Engineering properties of soils and materials
    1. Index properties (e.g., plasticity index; interpretation and how to use them)
B. Soil mechanics analysis
    1. Expansive soils
C. Shallow foundations
    1. Mat and raft foundations
D. Deep foundations
    1. Axial capacity (single pile/drilled shaft)
    2. Lateral capacity and deflections (single pile/drilled shaft)
    3. Settlement
    4. Behavior of pile and/or drilled shaft group
E. Engineering Economics
    1. Value engineering and costing
F. Material Quality Control and Production
    1. Welding and bolting testing
G. Temporary Structures
    1. Formwork
    2. Falsework and scaffolding
    3. Shoring and reshoring
    4. Concrete maturity and early strength evaluation
    5. Bracing
    6. Anchorage
H. Worker Health, Safety and Environment
    1. OSHA regulations
    2. Safety management

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Vertical Forces (Gravity/Other) and Incidental Lateral Component of the Structural Engineering BREADTH Exam Specifications

Effective Beginning with the April 2011 Examinations

- The 4-hour **Vertical Forces (Gravity/Other) and Incidental Lateral** breadth examination is offered on Friday morning and focuses on gravity loads. It contains 40 multiple-choice questions.
- The exam uses the US Customary System (USCS) of units.
- The exam is developed with questions that will require a variety of approaches and methodologies, including design, analysis, and application.
- The knowledge areas specified as examples of kinds of knowledge are not exclusive or exhaustive categories.
- Score results are combined with depth exam results for final score of this component.

	Approximate Percentage of Examination
I. Analysis of Structures	**30%**
A. Loads	10%
1. Dead	
2. Live	
3. Snow, including drifting	
4. Moving (e.g., vehicular, pedestrian, crane)	
5. Thermal	
6. Shrinkage and creep	
7. Impact (e.g., vehicular, crane, and elevator)	
8. Settlement	
9. Ponding	
10. Fluid	
11. Ice	
12. Static earth pressure	
13. Hydrostatic	
14. Hydraulics (e.g., stream flow, wave action, scour, flood)	
B. Methods	20%
1. Statics (e.g., determinate, location of forces and moments, free-body diagrams)	
2. Shear and moment diagrams	
3. Code coefficients and tables	
4. Computer-generated structural analysis techniques (e.g., modeling, interpreting, and verifying results)	
5. Simplified analysis methods (e.g., influence lines, portal frame method/cantilever method)	
6. Indeterminate analysis methods (e.g., deflection compatibility)	

II. Design and Details of Structures — 65%

A. General Structural Considerations — 7.5%
   1. Material properties and standards
   2. Load combinations
   3. Serviceability requirements
      (a) Deflection
      (b) Camber
      (c) Vibration
   4. Fatigue (for AASHTO concrete and steel)
   5. Bearings
   6. Expansion joints
   7. Corrosion

B. Structural Systems Integration — 2.5%
   1. Specifications, quality controls and coordination with other disciplines
   2. Constructability
   3. Construction sequencing
   4. Strengthening existing systems: reinforcing methods

C. Structural Steel — 12.5%
   1. Tension members
   2. Columns and compression members
   3. Base plates
   4. Beams
   5. Plate girders—straight
   6. Plate girders—curved
   7. Trusses
   8. Beam-columns
   9. Connections—welded
   10. Connections—bolted
   11. Moment connections
   12. Weld design
   13. Composite steel design
   14. Relief angle (e.g., masonry support angle, facade support angle)
   15. Bridge piers
   16. Bridge cross-frame diaphragms

D. Light Gage/Cold-Formed Steel — 2.5%
   1. Framing
   2. Connections
   3. Web crippling

E. Concrete — 12.5%
   1. Flexural members (e.g., beams, joists, bridge decks, and slabs)
   2. Design for shear
   3. Columns and compression members
   4. Two-way slab systems
   5. Pre-tensioned concrete
   6. Post-tensioned concrete

7. Attachment of elements and anchorage to concrete (e.g., inserts, attachment plates, dowels)
8. Bridge piers
9. Crack control
10. Composite design
11. Slab-on-grade

F. Wood 10%
1. Sawn beams
2. Glue-laminated beams
3. Engineered lumber
4. Columns
5. Bearing walls
6. Trusses
7. Bolted, nailed, and screwed connections

G. Masonry 7.5%
1. Flexural members
2. Compression members
3. Bearing walls
4. Detailing (e.g., crack control, deflection, masonry openings)

H. Foundations and Retaining Structures 10%
1. Use of design pressure coefficients (e.g., active, passive, at rest, bearing, coefficient of friction, cohesion)
2. Selection of foundation systems (e.g., based on geotechnical information, boring logs, settlement, and groundwater table)
3. Overturning, sliding and bearing
4. Combined footings/mat foundations
5. Piles (concrete, steel, timber)
6. Drilled shafts/drilled piers/caissons
7. Gravity walls
8. Anchored walls
9. Cantilever walls
10. Basement walls for buildings
11. Effect of adjacent loads
12. Use of modulus of sub-grade reaction

III. Construction Administration 5%

A. Procedures for Mitigating Nonconforming Work
B. Inspection Methods

Vertical Forces (Gravity/Other) and Incidental Lateral Component of the Structural Engineering DEPTH Exam Specifications

Effective Beginning with the April 2011 Examination

The 4-hour **Vertical Forces (Gravity/Other) and Incidental Lateral** depth examination is offered on Friday afternoon. The depth modules of the Structural Engineering exam focus on a single area of practice in structural engineering. Examinees must choose either the **BUILDINGS** or the **BRIDGES** module. Examinees must work the same module on both components. That is, if bridges is the module chosen in the Vertical Forces component, then bridges must be the module chosen in the Lateral Forces component. All questions are constructed response (essay).

The exam uses the US Customary System (USCS) of units.

BUILDINGS

The **Vertical Forces (Gravity/Other) and Incidental Lateral** Structural Engineering depth exam in **BUILDINGS** covers loads, lateral earth pressures, analysis methods, general structural considerations (element design), structural systems integration (connections), and foundations and retaining structures. This 4-hour module contains one problem from each of the following areas:

- Steel structure
- Concrete structure
- Wood structure
- Masonry structure

All problems are equally weighted. At least one problem includes a multistory building, and at least one problem includes a foundation.

BRIDGES

The **Vertical Forces (Gravity/Other) and Incidental Lateral** Structural Engineering depth exam in **BRIDGES** covers gravity loads, superstructures, substructures, and lateral loads other than wind and seismic and may test pedestrian bridge and/or vehicular bridge knowledge. This 4-hour module contains three problems, one from each of the following areas:

- Concrete superstructure (25% of your score)
- Other elements of bridges (e.g., culverts, abutments, retaining walls) (25% of your score)
- Steel superstructure (50% of your score)

Lateral Forces (Wind/Earthquake) Component of the Structural Engineering BREADTH Exam Specifications

Effective Beginning with the April 2011 Examination

- The 4-hour **Lateral Forces (Wind/Earthquake)** breadth examination is offered on Saturday morning and focuses on wind/earthquake loads. It contains 40 multiple-choice questions.
- The exam uses the US Customary System (USCS) of units.
- The exam is developed with questions that will require a variety of approaches and methodologies, including design, analysis, and application.
- The knowledge areas specified as examples of kinds of knowledge are not exclusive or exhaustive categories.
- Score results are combined with depth exam results for final score of this component.

		Approximate Percentage of Examination
I.	**Analysis of Structures**	**37%**
	A. Lateral Forces	10%
	1. Wind	
	2. Horizontal seismic	
	3. Vertical seismic	
	4. Dynamic earth pressure	
	B. Lateral Force Distribution	22%
	1. Statics (e.g., determinate and indeterminate, location of forces and moments, free-body diagrams)	
	2. Seismic design categories (C and lower)	
	3. Seismic design categories (D and higher)	
	4. Seismic static force procedures	
	5. Seismic dynamic force procedures	
	6. Configuration of a structural system to resist effects of horizontal torsional moments	
	7. Relative rigidity force distribution	
	8. Horizontal/plan and vertical irregularities	
	9. Flexible diaphragms	
	10. Rigid diaphragms	
	11. Simplified wind	
	12. Wind analytic procedures	
	13. Wind components and cladding	
	14. Main wind force resisting systems	
	C. Methods	5%
	1. Computer-generated structural analysis techniques (e.g., modeling, interpreting, and verifying results)	
	2. Simplified analysis methods (e.g., influence lines, portal frame method/cantilever method)	

II. Design and Detailing of Structures — 60%

A. General Structural Considerations — 7.5%
   1. Load combinations
   2. Serviceability requirements: building drift
   3. Anchorage of a structural system to resist uplift and sliding forces
   4. Components, attachments, and cladding
   5. Redundancy factors
   6. Overstrength
   7. Ductility requirements
   8. Abutment/pier seat width

B. Structural Systems Integration — 5%
   1. Structural systems to resist effects of lateral forces
   2. Constructability
   3. Strengthening existing systems: seismic retrofit
      a. Details
      b. System compatibility

C. Structural Steel — 10%
   1. Ordinary moment frames
   2. Intermediate moment-resisting frames
   3. Special moment-resisting frames
   4. Bracing
   5. Ordinary concentric braced frames
   6. Special concentric braced frames
   7. Eccentric braced frames
   8. Bridge piers

D. Light Gage/Cold-Formed Steel — 2.5%
   1. Metal deck diaphragms
   2. Light-framed wall systems (e.g., shearwall systems)

E. Concrete — 12.5%
   1. Ordinary or intermediate shear walls
   2. Special shear walls
   3. Ordinary or intermediate moment-resisting frames
   4. Special moment-resisting frames
   5. Diaphragms
   6. Reinforcement details (e.g., ductile detailing, anchorage)
   7. Bridge piers
   8. Tilt-up construction

F. Wood — 7.5%
   1. Shear walls
   2. Plywood diaphragms (e.g., drag struts, chords)
   3. Plywood sub-diaphragms

G. Masonry — 7.5%
   1. Flexural-compression members
   2. Slender walls
   3. Ordinary or intermediate shear walls
   4. Special shear walls

5. Anchorage for walls (e.g., out-of-plane)
6. Attachment of elements to masonry

H. Foundations and Retaining Structures 7.5%

1. Spread footings
2. Piles (concrete, steel, timber)
3. Drilled shafts/drilled piers/caissons

III. Construction Administration 3%

A. Structural observation

Lateral Forces (Wind/Earthquake) Component of the Structural Engineering DEPTH Exam Specifications

Effective Beginning with the April 2011 Examination

The 4-hour **Lateral Forces (Wind/Earthquake)** depth examination is offered on Saturday afternoon. The depth modules of the Structural Engineering exam focus on a single area of practice in structural engineering. Examinees must choose either the **BUILDINGS** or the **BRIDGES** module. Examinees must work the same module on both components. That is, if bridges is the module chosen in the Vertical Forces component, then bridges must be the module chosen in the Lateral Forces component. All questions are constructed response (essay).

The exam uses the US Customary System (USCS) of units.

BUILDINGS

The **Lateral Forces (Wind/Earthquake)** Structural Engineering depth exam in **BUILDINGS** covers lateral forces, lateral force distribution, analysis methods, general structural considerations (element design), structural systems integration (connections), and foundations and retaining structures. This 4-hour module contains one problem from each of the following areas:

- Steel structure
- Concrete structure
- Wood and/or masonry structure
- General analysis (e.g., existing structures, secondary structures, nonbuilding structures, and/or computer verification)

All problems are equally weighted.

At least two problems include seismic content at Seismic Design Category D and above.
At least one problem includes wind content of at least 110 mph.
Problems may include a multistory building.
Problems may include a foundation.

BRIDGES

The **Lateral Forces (Wind/Earthquake)** Structural Engineering depth exam in **BRIDGES** covers gravity loads, superstructures, substructures, and lateral forces and may test pedestrian bridge and/or vehicular bridge knowledge. This 4-hour module contains three problems, one from each of the following areas:

- Columns (25% of your score)
- Footings (25% of your score)
- General analysis (i.e., seismic and/or wind) (50% of your score)

NCEES
Structural Engineering Exam Specifications
16-hour exam

EFFECTIVE October 1985 – October 1986 Exams

Subject	Part I 8 Hours			Part II 8 Hours	
	Problem Number			Problem Number	
	Morning* Session	Afternoon* Session		Morning* Session	Afternoon* Session
STRUCTURAL CONCRETE Buildings or Building Elements (i.e., Beams, Columns, Walls, Connections)	270	570		280	580
Foundations or Retaining Structures	271	571		281	581
STRUCTURAL STEEL & LIGHT METAL Buildings or Building Elements (i.e., Beams, Columns, Connections) or Other Structure	272	572		282	582
BRIDGES OR BRIDGE ELEMENTS	273	573		283	583
WOOD Buildings or Building Elements (i.e., Beams, Columns, Connections)		574			584
MASONRY Buildings or Building Elements (i.e., Walls, Lintels, Columns)	274			284	
LATERAL FORCES Wind and/or Seismic, Buildings or Any Structure	275	575		285	585
TOTAL No. Problems	6	6		6	6

* You are to work any four (4) problems selected from the six (6) problems listed below, in accordance with local instructions.

NCEES
Structural I Engineering Exam Specifications
8-hour exam

EFFECTIVE October 1987 – October 1988 Exams

Subject	Morning Problem Number	Afternoon Problem Number
STRUCTURAL CONCRETE Buildings or Building Elements (i.e., Beams, Columns, Walls, Connections)	270	570
Foundations or Retaining Structures	271	571
STRUCTURAL STEEL & LIGHT METAL Buildings or Building Elements (i.e., Beams, Columns, Connections) or Other Structures	272	572
BRIDGES OR BRIDGE ELEMENTS	273	573
WOOD Buildings or Building Elements (i.e., Beams, Columns, Connections)	x	574
MASONRY Buildings or Building Elements (i.e., Walls, Lintels, Columns)	274	x
LATERAL FORCES Wind and/or Seismic, Buildings or Any Structure	275	575

Note: Examinees are to work any four (4) problems selected from the six (6) problems listed, in accordance with local instructions.

NCEES
Structural I Engineering Exam Specifications
8-hour exam

EFFECTIVE April 1989 – April 1991 Exams

Subject	Morning Problem Number	Afternoon Problem Number
STRUCTURAL CONCRETE Buildings or Building Elements (i.e., Beams, Columns, Walls, Connections)	270	570
Foundations and Retaining Structures	271	571
STRUCTURAL STEEL & LIGHT METAL Buildings or Building Elements (i.e., Beams, Columns, Connections) or Other Structures	272	572
BRIDGES OR BRIDGE ELEMENTS	273	573
MASONRY Buildings or Building Elements (i.e., Walls, Lintels, Columns)	274	x
TIMBER Buildings or Buildings Elements (i.e., Beams, Columns, Connections)	x	574
LATERAL FORCES Wind and/or Seismic on Buildings or Other Structures	275	575

Note: Examinees are to work any four (4) problems selected from the six (6) problems listed, in accordance with local instructions.

NCEES
STRUCTURAL I Exam Specifications
8-hour exam

EFFECTIVE October 1991 – October 1996 Exams

		PROBLEM NUMBER	
		Morning Essay	Afternoon Multiple-Choice
1.	**STRUCTURAL CONCRETE** buildings or building elements (i.e., beams, columns, walls, connections)	270	570
2.	**FOUNDATIONS OR RETAINING STRUCTURES**	271	571
3.	**STRUCTURAL STEEL & LIGHT METAL** buildings, building elements (i.e., beams, columns, connections), or other structures	272	572
4.	**BRIDGES OR BRIDGE ELEMENTS** concrete and/or steel	273	573
5.	**TIMBER OR MASONRY** buildings or building elements (i.e., beams, columns, connections, walls, lintels)	274	574
6.	**LATERAL FORCES** buildings or other structures subjected to wind and/or seismic forces	275	575
	Total number of problems =	6	6

Notes

Examinees are to work any eight (8) problems out of twelve (12), subject to local board rules.

Effective with the April 1996 exam, all multiple-choice questions will have four answer options: (A), (B), (C), and (D). There will no longer be an (E) option.

There will be a new specifications list available for the Structural I examination in November 1996.

NCEES
STRUCTURAL I Exam Specifications
8-hour exam

EFFECTIVE April 1997 – October 1999 Exams

		Number of Problems
1.	**BUILDINGS - CONCRETE** i.e., beams, slabs, columns, walls, connections	1
2.	**FOUNDATIONS OR RETAINING STRUCTURES**	1
3.	**BUILDINGS - STEEL** i.e., beams, columns, connections	1
4.	**BRIDGES** concrete and/or steel	1
5.	**BUILDINGS - TIMBER** i.e., beams, lintels, columns, walls, connections	1
6.	**LATERAL FORCES** buildings and/or bridges; i.e., wind and seismic	1
7.	**BUILDINGS - MASONRY** i.e., beams, lintels, columns, walls, connections	1
8.	**SPECIAL PERFORMANCE** i.e., building systems, specifications, structural behavior, ethics	1
	Total number of problems =	8

Note: Examinees work all eight (8) problems.

NCEES
STRUCTURAL I Exam Specifications
8-hour exam

EFFECTIVE April 2000 – October 2003

	Approximate Percentage of Examination
I. ANALYSIS	
A. Loads, Moments, Shears and Deflections Vertical Loads (Static, moving, snow), Lateral Loads (Earth/hydraulic, seismic, wind), Temperature, Shrinkage and/or Creep Effects, Miscellaneous Bridge Loads, Load Combinations	22%
B. Structural Stability Overturning, Sliding, Load Path	15%
II. DESIGN	
A. Flexure and Shear/Torsion Reinforced Concrete, Pre-stressed Concrete, Structural Steel, Timber, Masonry, Composite Construction	20%
B. Axial Load and/or Combined Bending and Axial Loaded Members (Columns, Walls, Truss Members), Reinforced Concrete, Structural Steel, Timber, Masonry, Composite Construction	13%
C. Foundations Shallow Foundations, Deep Foundations	8%
D. Connections (Including Lateral Loads) Reinforced Concrete, Pre-stressed Concrete, Structural Steel, Timber, Masonry	10%
E. Lateral Load Resisting Structures Diaphragms, Shear Walls, Frames	12%
	Total =100%

Notes:
1. The examination is developed with problems that will require a variety of approaches and methodologies including design, analysis and application. Some problems may require knowledge of engineering economics. Approximately 20% of the exam will test bridge knowledge.

2. Examinees will work all questions.

NCEES
STRUCTURAL I Exam Specifications

EFFECTIVE April 2004 – October 2010 Exams

- The exam is an 8-hour open-book exam. It contains 40 multiple-choice questions in the 4-hour morning session, and 40 multiple-choice questions in the 4-hour afternoon session. Examinee works all questions.
- The exam uses the US Customary System (USCS) of units.
- The exam is developed with questions that will require a variety of approaches and methodologies, including design, analysis, and application. Approximately 20% of the exam will test bridge knowledge.
- The knowledge areas specified as examples of kinds of knowledge are not exclusive or exhaustive categories.
- The design standards applicable to the structural exam are shown on the last page.

	Approximate Percentage of Examination
I. Analysis of Structures	**31%**
A. Loads	7%
1. Dead loads (e.g., weight of the structure, equipment weights, facades)	
2. Superimposed and live (e.g., finishes, mechanical equipment, partition loads, live load reductions, pattern, skip, pedestrian)	
3. Snow (e.g., drifting)	
4. Moving (e.g., vehicular, pedestrian, crane)	
5. Thermal	
6. Shrinkage and creep	
7. Impact (e.g., vehicular, crane and elevator)	
8. Settlement	
9. Ponding	
10. Hydraulics (e.g., stream flow, wave action, scour)	
B. Lateral Forces	8%
1. Wind	
2. Seismic	
3. Earth retention	
4. Hydrostatic	
C. Lateral Force Distribution	11%
1. Statics (e.g., determinate and indeterminate, location of forces and moments, rigid body diagrams)	
2. Development of a structural system to resist effects of lateral forces	
3. Seismic static force analysis procedures	
4. Code requirements pertaining to the configuration of a structural system to resist effects of horizontal torsional moments	
5. Relative rigidity force distribution analysis (e.g., rotational analysis)	
6. Procedures to analyze building with horizontal/plan and vertical irregularities	
7. Procedures to analyze diaphragms (e.g., flexible and rigid diaphragms)	

8. Code-prescribed static lateral force analysis procedures to determine limitations of story drift
9. Wind analysis procedures

D. Methods 5%
1. Computer-generated structural analysis techniques (e.g., modeling, interpreting and verifying results)
2. Code coefficients and tables
3. Force diagrams
4. Simplified analysis methods (e.g., moment distributions, influence lines, portal frame method/cantilever method)
5. Shear and moments diagrams

II. Design and Details of Structures 69%

A. General Structural Considerations 7%
1. Material properties and standards
2. Load combinations
3. Deflection
4. Camber
5. Vibration
6. Anchorage of a structural system to resist uplift and sliding forces
7. Fatigue (for concrete and steel, AASHTO)
8. Strengthening systems to improve existing structural capacity
9. Specifications, quality controls and coordination with other disciplines

B. Steel (AISC/AASHTO, ASD/LFD/LRFD) 18%
1. Tension members
2. Columns
3. Base plates/anchor bolts
4. Beams, plate girders
5. Trusses
6. Beam-columns
7. Connections (e.g., bolted, welded)
8. Ordinary moment frames
9. Special moment resisting frames
10. Bracing
11. Ordinary braced frames
12. Eccentric braced frames
13. Composite steel design

C. Concrete (AASHTO/ACI/PCI, Strength Design, LRFD) 16%
1. Working stress/strength design for bridges
2. Flexural members (e.g., beams, joists, bridge decks and slabs)
3. Compression members
4. Two-way slab systems
5. Pre-stressed concrete
6. Shear walls
7. Attachment of elements to concrete (e.g., inserts, attachment plates, dowels)
8. Diaphragms
9. Reinforcing bar details
10. Bridge piers
11. Crack control
12. Flexural-compression members

D. Wood (NDS/ASD) 9%
   1. Sawn beams
   2. Glue-laminated beams
   3. Columns
   4. Bearing walls
   5. Shear walls
   6. Plywood diaphragms (e.g., drag struts, chords)
   7. Trusses
   8. Bolted, nailed, and screwed connections

E. Masonry (ACI 530, Working Stress/Strength Design) 9%
   1. Reinforced masonry
   2. Flexural members
   3. Compression members
   4. Flexural-compression members
   5. Bearing walls
   6. Slender walls
   7. Shear walls
   8. Seismic detailing for shear walls and nonbearing walls
   9. Attachment of elements to masonry

F. Foundations and Retaining Structures 10%
   1. Design coefficients (e.g., active, passive, at rest, bearing, coefficient of friction, cohesion)
   2. Soil profiles in selection of foundation systems (e.g., geotechnical reports, boring logs, settlement, and groundwater table)
   3. Overturning, sliding, and bearing
   4. Spread footings
   5. Combined footings/mat foundations
   6. Piles (concrete, steel)
   7. Drilled shaft/drilled pier/caisson
   8. Gravity walls
   9. Cantilever walls
   10. Basement walls for buildings
   11. Effect of loads placed adjacent to foundation

NCEES
STRUCTURAL II Exam Specifications
8-hour exam

EFFECTIVE October 1987

MORNING (Essay)

You are to work any one (1) problem selected from the three (3) problems listed below.

	PROBLEM NUMBER
STEEL BRIDGE	360
STEEL BUILDING	361
FOUNDATION	362

AFTERNOON (Essay)

You are to work any one (1) problem selected from the three (3) problems listed below.

	PROBLEM NUMBER
CONCRETE BRIDGE	660
CONCRETE BUILDING	661
MISCELLANEOUS STRUCTURE	662

NCEES
STRUCTURAL II Exam Specifications
8-hour exam

EFFECTIVE October 1988 – April 1993

MORNING (Essay)

You are to work any one (1) problem selected from the three (3) problems listed below.

	PROBLEM NUMBER
BRIDGE	360
BUILDING	361
FOUNDATION	362

AFTERNOON (Essay)

You are to work any one (1) problem selected from the three (3) problems listed below.

	PROBLEM NUMBER
BRIDGE	660
BUILDING	661
LATERAL FORCES Wind and/or Seismic on Buildings or Other Structures	662

NCEES
STRUCTURAL II Exam Specifications
8-hour exam

EFFECTIVE October 1993 – October 1996

MORNING (Essay)

You are to work any one (1) problem selected from the three (3) problems listed below.

		PROBLEM NUMBER
1.	**BRIDGES** concrete and/or steel	360
2.	**BUILDINGS** concrete and/or steel	361
3.	**FOUNDATIONS AND/OR RETAINING STRUCTURES**	362

Total number of problems = 3

AFTERNOON (Essay)
All afternoon problems have seismic content.

You are to work any one (1) problem selected from the three (3) problems listed below.

		PROBLEM NUMBER
4.	**BRIDGES** concrete and/or steel	660
5.	**BUILDINGS** concrete and/or steel	661
6.	**BUILDINGS** masonry and/or timber or special structures	662

Total number of problems = 3

Note
There will be a new specifications list available for the Structural II examination in November 1996.

NCEES
STRUCTURAL II Exam Specifications
8-hour exam

EFFECTIVE April 1997 – October 2003

		Number of Problems
	MORNING SESSION (Essay)	
1.	**BRIDGES** concrete and/or steel	1
2.	**BUILDINGS** concrete, masonry, steel, and/or timber	1
	Total number of problems =	2
	AFTERNOON SESSION (Essay) All afternoon problems have seismic content.	
3.	**BRIDGES with SEISMIC** concrete and/or steel	1
4.	**BUILDINGS with SEISMIC** concrete, masonry, steel, and/or timber	1
	Total number of problems =	2

Note: Examinees are to work any one (1) problem selected from the two (2) problems presented in each session, in accordance with local instructions. All problems are essay type.

NCEES
STRUCTURAL II Exam Specifications
8-hour exam

EFFECTIVE April 2004 – October 2010

All problems are essay type. Four problems will be presented in each of the 4-hour sessions (morning and afternoon): two problems in buildings and two problems in bridges. Examinees are to work both problems presented in either buildings or bridges in each session, in accordance with local instructions. Therefore if building problems are worked in the morning session, then building problems must also be worked in the afternoon session; if bridge problems are worked in the morning session, then bridge problems must also be worked in the afternoon session.

The exam uses the US Customary System (USCS) of units.

Buildings

The exam will test the following skills: defining the scope of work, reading and interpreting drawings, determining the method of analysis and applicable code requirements, using professional judgment in making design assumptions, integrating design requirements and organizing calculations, integrating analysis and design, following through from design into drawings and details, sketching details, applying quality control procedures to calculations and construction documents, and modifying structural elements as a result of coordinating with other design disciplines.

The exam content will include loads, forces, vertical support systems, lateral resisting systems, connections, and foundations.

Each examination will emphasize one of each of the following problem types:
1. Steel structure
2. Concrete structure
3. Wood and/or masonry structure
4. General analysis (e.g., existing structure, secondary structures, nonbuilding structures, and/or computer verification)

Two of the four problems in buildings will have seismic content.

Bridges

The exam will test the following skills: defining the scope of work, reading and interpreting drawings, determining the method of analysis and applicable code requirements, using professional judgment in making design assumptions, integrating design requirements and organizing calculations, integrating analysis and design, following through from design into drawings and details, sketching details, applying quality control procedures to calculations and construction documents, and modifying structural elements as a result of coordinating with other design disciplines. The exam content will include loads, superstructure, and substructure.

Each examination will emphasize one of each of the following problem types:
1. Steel bridge
2. Concrete bridge
3. Pier
4. General analysis (e.g., existing structure, culverts, retaining walls and abutments, and/or computer verification)

Each examination may test pedestrian bridge and/or vehicular bridge knowledge. Two of the four problems in bridges will have seismic content.