

**NCEES Principles and Practice of Engineering
CIVIL BREADTH Exam Specifications**

Effective Beginning with the April 2008 Examinations

The civil engineering examination is a breadth and depth examination. This means that **all** examinees work the breadth (AM) exam and **one** of the five depth (PM) exams. The five areas covered in the civil engineering exam 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.

The specifications for the **AM exam and the Geotechnical PM exam** are included here.

	Approximate Percentage of Examination
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

Notes

1. The examination is developed with questions that will require a variety of approaches and methodologies including design, analysis, and application. Some questions may require knowledge of engineering economics.
2. The knowledge areas specified under 1, 2, 3, etc., are examples of kinds of knowledge, but they are not exclusive or exhaustive categories.
3. The breadth (AM) exam contains 40 multiple-choice questions. Examinee works all questions.
4. Score results are combined with depth exam results for final score.

**NCEES Principles and Practice of Engineering Examination
CIVIL–GEOTECHNICAL Depth Exam Specifications**

Effective Beginning with the April 2008 Examinations

	Approximate Percentage of Examination
I. Subsurface Exploration and Sampling	7.5%
A. Drilling and sampling procedures	
B. Soil classification	
C. General rock characterization (e.g., RQD, description, joints and fractures)	
D. Boring log interpretation (e.g., soil profile)	
E. In situ testing	
II. Engineering Properties of Soils and Materials	12.5%
A. Index properties	
B. Phase relationships	
C. Permeability	
D. Geosynthetics	
E. Pavement design criteria	
F. Shear strength properties	
G. Frost susceptibility	
III. Soil Mechanics Analysis	12.5%
A. Pressure distribution	
B. Lateral earth pressure	
C. Consolidation	
D. Compaction	
E. Expansive soils	
F. Effective and total stresses	
G. Seepage (e.g., exit gradient, drain fields, seepage forces, flow nets)	
IV. Earthquake Engineering	5%
A. Liquefaction	
B. Pseudo-static analysis	
C. Seismic site characterization	
V. Earth Structures	10%
A. Slope stability	
B. Slabs-on-grade	
C. Earth dams	
D. Techniques and suitability of ground modification	
VI. Shallow Foundations	15%
A. Bearing capacity	
B. Settlement	
C. Mat and raft foundations	

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| VII. Earth Retaining Structures | 15% |
| <ul style="list-style-type: none"> A. Gravity walls B. Cantilever walls C. Stability analysis D. Mechanically stabilized earth walls E. Braced and anchored excavations F. Soil and rock anchors | |
| VIII. Deep Foundations | 10% |
| <ul style="list-style-type: none"> A. Axial capacity (single pile/drilled shaft) B. Lateral capacity and deflections (single pile/drilled shaft) C. Settlement D. Behavior of pile and/or drilled shaft group E. Pile load test F. Pile installation G. Pile dynamics (e.g., wave equation, PDA test) | |
| IX. Other Topics | 12.5% |
| <ul style="list-style-type: none"> A. Groundwater and well fields <ul style="list-style-type: none"> 1. Well logging and subsurface properties 2. Aquifers (e.g., characterization) 3. Groundwater flow including Darcy’s Law and seepage analysis 4. Well analysis (steady flow only) 5. Groundwater control including drainage, construction dewatering B. Loadings <ul style="list-style-type: none"> 1. Earthquake loads C. Construction operations and methods <ul style="list-style-type: none"> 1. Dewatering and pumping 2. Quality control process (QA/QC) (e.g., when digging, confirming quality; writing QA processes) D. Temporary structures <ul style="list-style-type: none"> 1. Shoring and reshoring 2. Concrete maturity and early strength evaluation 3. Bracing 4. Anchorage 5. Cofferdams (systems for temporary excavation support) E. Worker health, safety, and environment <ul style="list-style-type: none"> 1. OSHA regulations 2. Safety management | |

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2. The knowledge areas specified under 1, 2, 3, etc., are examples of kinds of knowledge, but they are not exclusive or exhaustive categories.
3. Each depth (PM) exam contains 40 multiple-choice questions. Examinee chooses **one** depth examination and works all questions in the depth examination chosen.
4. Score results are combined with breadth exam results for final score.