

**Principles and Practice of Engineering  
 CIVIL BREADTH and GEOTECHNICAL DEPTH Exam Specifications**

- 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 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.
- Examinees work all questions in the morning session and all questions in the afternoon module they have chosen. Depth results are combined with breadth results for final score.
- 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.
- The specifications for the **AM exam** and the **Geotechnical PM exam** are included here.

**CIVIL BREADTH Exam Specifications**

Effective Beginning with the April 2008 Examinations

	Approximate Percentage of AM Exam
<b>I. Construction</b>	<b>20%</b>
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 load	

- 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. Footing

- 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

**PE Civil—GEOTECHNICAL Depth Exam Specifications**  
**Effective Beginning with the October 2011 Examinations**

Effective with the October 2011 exam, five knowledge areas in the Civil–Geotechnical depth exam specification have been reorganized. Some knowledge and subknowledge areas in Sections III, IV, VII, VIII, and IX were rearranged. The reorganization does not affect exam content. The Civil breadth exam specifications have not changed.

	<b>Approximate Percentage of PM Exam</b>
<b>I. Subsurface Exploration and Sampling</b> 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	<b>7.5%</b>
<b>II. Engineering Properties of Soils and Materials</b> A. Index properties B. Phase relationships C. Permeability D. Geosynthetics E. Pavement design criteria F. Shear strength properties G. Frost susceptibility	<b>12.5%</b>
<b>III. Soil Mechanics Analysis</b> A. Pressure distribution B. Lateral earth pressure C. Consolidation D. Compaction E. Expansive soils F. Effective and total stresses	<b>12.5%</b>
<b>IV. Earthquake Engineering</b> A. Liquefaction B. Pseudo-static analysis and earthquake loadings C. Seismic site characterization	<b>5%</b>
<b>V. Earth Structures</b> A. Slope stability B. Slabs-on-grade C. Earth dams D. Techniques and suitability of ground modification	<b>10%</b>
<b>VI. Shallow Foundations</b> A. Bearing capacity B. Settlement C. Mat and raft foundations	<b>15%</b>

<b>VII.</b>	<b>Earth Retaining Structures, Including Temporary Structures</b>	<b>17.5%</b>
	<ul style="list-style-type: none"> <li>A. Gravity walls and cofferdams</li> <li>B. Cantilever walls</li> <li>C. Stability analysis</li> <li>D. Mechanically stabilized earth walls</li> <li>E. Braced and anchored excavations</li> <li>F. Soil and rock anchors</li> <li>G. Temporary structures, including shoring and re-shoring</li> </ul>	
<b>VIII.</b>	<b>Deep Foundations</b>	<b>10%</b>
	<ul style="list-style-type: none"> <li>A. Axial capacity (single pile/drilled shaft)</li> <li>B. Lateral capacity and deflections (single pile/drilled shaft)</li> <li>C. Settlement</li> <li>D. Behavior of pile and/or drilled shaft group</li> <li>E. Pile load test</li> <li>F. Pile installation</li> <li>G. Pile dynamics (e.g., wave equation, high-strain dynamic testing)</li> </ul>	
<b>IX.</b>	<b>Other Topics</b>	<b>10%</b>
	<ul style="list-style-type: none"> <li>A. Groundwater and well fields               <ul style="list-style-type: none"> <li>1. Well logging and subsurface properties</li> <li>2. Aquifers (e.g., characterization)</li> <li>3. Groundwater flow including Darcy’s Law and seepage analysis</li> <li>4. Well analysis (steady flow only)</li> <li>5. Groundwater control, including drainage, construction dewatering, and pumping</li> <li>6. Seepage (e.g., exit gradient, drain fields, seepage forces, flow nets)</li> </ul> </li> <li>B. Construction operations and methods               <ul style="list-style-type: none"> <li>1. Quality control process (QA/QC) (e.g., when digging, confirming quality; writing QA processes)</li> <li>2. Concrete maturity and early strength evaluation</li> <li>3. Worker health, safety, and environment, including OSHA regulations</li> </ul> </li> </ul>	
<b>Total</b>		<b>100%</b>