

National Council of Examiners for Engineering and Surveying

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.

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

Total**100%****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.