NCEES
advancing licensure for engineers and surveyors

NCEES Principles and Practice of Engineering Examination
CIVIL BREADTH and GEOTECHNICAL DEPTH Exam Specifications

Effective Beginning with the April 2015 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 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. The **design standards** applicable to the Geotechnical PM exam are shown on the last page.

CIVIL BREADTH Exam Specifications

		Approximate Number of Questions
I.	**Project Planning**	**4**
	A. Quantity take-off methods	
	B. Cost estimating	
	C. Project schedules	
	D. Activity identification and sequencing	
II.	**Means and Methods**	**3**
	A. Construction loads	
	B. Construction methods	
	C. Temporary structures and facilities	
III.	**Soil Mechanics**	**6**
	A. Lateral earth pressure	
	B. Soil consolidation	
	C. Effective and total stresses	
	D. Bearing capacity	
	E. Foundation settlement	
	F. Slope stability	

IV. Structural Mechanics — 6

A. Dead and live loads
B. Trusses
C. Bending (e.g., moments and stresses)
D. Shear (e.g., forces and stresses)
E. Axial (e.g., forces and stresses)
F. Combined stresses
G. Deflection
H. Beams
I. Columns
J. Slabs
K. Footings
L. Retaining walls

V. Hydraulics and Hydrology — 7

A. Open-channel flow
B. Stormwater collection and drainage (e.g., culvert, stormwater inlets, gutter flow, street flow, storm sewer pipes)
C. Storm characteristics (e.g., storm frequency, rainfall measurement and distribution)
D. Runoff analysis (e.g., Rational and SCS/NRCS methods, hydrographic application, runoff time of concentration)
E. Detention/retention ponds
F. Pressure conduit (e.g., single pipe, force mains, Hazen-Williams, Darcy-Weisbach, major and minor losses)
G. Energy and/or continuity equation (e.g., Bernoulli)

VI. Geometrics — 3

A. Basic circular curve elements (e.g., middle ordinate, length, chord, radius)
B. Basic vertical curve elements
C. Traffic volume (e.g., vehicle mix, flow, and speed)

VII. Materials — 6

A. Soil classification and boring log interpretation
B. Soil properties (e.g., strength, permeability, compressibility, phase relationships)
C. Concrete (e.g., nonreinforced, reinforced)
D. Structural steel
E. Material test methods and specification conformance
F. Compaction

VIII. Site Development — 5

A. Excavation and embankment (e.g., cut and fill)
B. Construction site layout and control
C. Temporary and permanent soil erosion and sediment control (e.g., construction erosion control and permits, sediment transport, channel/outlet protection)
D. Impact of construction on adjacent facilities
E. Safety (e.g., construction, roadside, work zone)

PE Civil—GEOTECHNICAL Depth Exam Specifications

		Approximate Number of Questions
I.	**Site Characterization**	**5**
	A. Interpretation of available existing site data and proposed site development data (e.g., aerial photography, geologic and topographic maps, GIS data, as-built plans, planning studies and reports)	
	B. Subsurface exploration planning	
	C. Geophysics (e.g., GPR, resistivity, seismic methods)	
	D. Drilling techniques (e.g., hollow stem auger, cased boring, mud rotary, air rotary, rock coring, sonic drilling)	
	E. Sampling techniques (e.g., split-barrel sampling, thin-walled tube sampling, handling and storage)	
	F. In situ testing (e.g., standard penetration testing, cone penetration testing, pressure meter testing, dilatometer testing, field vane shear)	
	G. Description and classification of soils (e.g., Burmeister, Unified Soil Classification System, AASHTO, USDA)	
	H. Rock classification and characterization (e.g., recovery, rock quality designation, RMR, weathering, orientation)	
	I. Groundwater exploration, sampling, and characterization	
II.	**Soil Mechanics, Laboratory Testing, and Analysis**	**5**
	A. Index properties and testing	
	B. Strength testing of soil and rock	
	C. Stress-strain testing of soil and rock	
	D. Permeability testing properties of soil and rock	
	E. Effective and total stresses	
III.	**Field Materials Testing, Methods, and Safety**	**3**
	A. Excavation and embankment, borrow source studies, laboratory and field compaction	
	B. Trench and construction safety	
	C. Geotechnical instrumentation (e.g., inclinometer, settlement plates, piezometer, vibration monitoring)	
IV.	**Earthquake Engineering and Dynamic Loads**	**2**
	A. Liquefaction analysis and mitigation techniques	
	B. Seismic site characterization, including site classification using ASCE 7	
	C. Pseudo-static analysis and earthquake loads	
V.	**Earth Structures**	**4**
	A. Slab on grade	
	B. Ground improvement (e.g., grouting, soil mixing, preconsolidation/wicks, lightweight materials)	
	C. Geosynthetic applications (e.g., separation, strength, filtration, drainage, reinforced soil slopes, internal stability of MSE)	
	D. Slope stability and slope stabilization	
	E. Earth dams, levees, and embankments	
	F. Landfills and caps (e.g., interface stability, drainage systems, lining systems)	

G. Pavement structures (rigid, flexible, or unpaved), including equivalent single-axle load (ESAL), pavement thickness, subgrade testing, subgrade preparation, maintenance and rehabilitation treatments

H. Settlement

VI. Groundwater and Seepage **3**

A. Seepage analysis/groundwater flow

B. Dewatering design, methods, and impact on nearby structures

C. Drainage design/infiltration

D. Grouting and other methods of reducing seepage

VII. Problematic Soil and Rock Conditions **3**

A. Karst; collapsible, expansive, and sensitive soils

B. Reactive/corrosive soils

C. Frost susceptibility

VIII. Earth Retaining Structures (ASD or LRFD) **5**

A. Lateral earth pressure

B. Load distribution

C. Rigid retaining wall stability analysis (e.g., CIP, gravity, external stability of MSE, crib, bin)

D. Flexible retaining wall stability analysis (e.g., soldier pile and lagging, sheet pile, secant pile, tangent pile, diaphragm walls, temporary support of excavation, braced and anchored walls)

E. Cofferdams

F. Underpinning (e.g., effects on adjacent construction)

G. Ground anchors, tie-backs, soil nails, and rock anchors for foundations and slopes

IX. Shallow Foundations (ASD or LRFD) **5**

A. Bearing capacity

B. Settlement, including vertical stress distribution

X. Deep Foundations (ASD or LRFD) **5**

A. Single-element axial capacity (e.g., driven pile, drilled shaft, micropile, helical screw piles, auger cast piles)

B. Lateral load and deformation analysis

C. Single-element settlement

D. Downdrag

E. Group effects (e.g., axial capacity, settlement, lateral deflection)

F. Installation methods/hammer selection

G. Pile dynamics (e.g., wave equation, high-strain dynamic testing, signal matching)

H. Pile and drilled-shaft load testing

I. Integrity testing methods (e.g., low-strain impact integrity testing, ultrasonic cross-hole testing, coring, thermal integrity testing)

NCEES Principles and Practice of Engineering Examination
GEOTECHNICAL Design Standards[1]

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ABBREVIATION	DESIGN STANDARD TITLE
ASCE 7	*Minimum Design Loads for Buildings and Other Structures*, 2010, American Society of Civil Engineers, Reston, VA.
OSHA 29 CFR	Part 1926, Safety and Health Regulations for Construction, US Department of Labor, Washington, DC. US federal version.

Note

1. Solutions to exam questions that reference a standard of practice are scored based on this list. Solutions based on other editions or standards will not receive credit.