

Appendix B
**Coding Six-Minute Items
(Civil PE)**

After you have written each item, decide whether it is a morning **breadth** question or an afternoon **depth** question. A **breadth** question is one in which the item could be solved correctly by someone who has just graduated from a four-year engineering degree program—that is, the knowledge required to solve the problem would normally be taught in such a program. A **depth** question is one for which the solution draws on knowledge that would be learned, encountered, developed, or enhanced after graduation.

For each item, decide on the primary subject tested (e.g., “Geotechnical” or “Structural”), then assign the item a code from the item classification codes provided in App. C.

Insert the code for the item directly after the item number, using the following format. Use all uppercase letters. Start with CE for “Civil,” followed by a D for “depth” or B for “breadth,” followed by the primary subject code, followed by the item classification code. Surround the entire code expression in square brackets. For example,

PROBLEM 3 [CE D GE EPPE] or PROBLEM 21 [CE B ST LDDL]

Note that some primary subject and item classification codes are the same for both breadth and depth questions.

Appendix C
Item Classification Codes
(Civil PE—BREADTH)

ENVIRONMENTAL (EN) — BREADTH

Wastewater Treatment

unit processes	CE B EN WWUP
wastewater flow rates	CE B EN WWFR
quantities	CE B EN WWQU
tests and testing	CE B EN WWTE
regulations	CE B EN WWRG
other	CE B EN WWOT

Biology

organisms (plant/animal)	CE B EN BIOR
degradation of streams and lakes	CE B EN BIDE
disinfection	CE B EN BIDI
water taste and odor	CE B EN BITA
BOD	CE B EN BIBO
toxicity	CE B EN BITX
temperature	CE B EN BITP
other	CE B EN BIOT

Solid/Hazardous Waste

quantity estimates	CE B EN SWQU
collection	CE B EN SWCO
storage/transfer	CE B EN SWST
treatment	CE B EN SWTR
disposal	CE B EN SWDI
site and haul economics	CE B EN SWEC
remediation	CE B EN SWRE
other	CE B EN SWOT

Groundwater and Well Fields

groundwater flow	CE B EN GWFL
aquifers	CE B EN GWAQ
wells and well fields	CE B EN GWWE
remediation	CE B EN GWRE
other	CE B EN GWOT

GEOTECHNICAL (GE)— BREADTH

Subsurface Exploration and Sampling

drilling and sampling	CE B GE SEDR
soil classification	CE B GE SECL
boring log interpretation	CE B GE SEBL
soil profile development	CE B GE SESP
other	CE B GE SEOT

Engineering Properties of Soils

index properties	CE B GE EPIN
phase relationships	CE B GE EPPH
permeability	CE B GE EPPE
shear strength properties	CE B GE EPSH
other	CE B GE EPOT

Soil Mechanics Analysis

pressure distribution	CE B GE SMPD
vertical pressure	CE B GE SMPV
lateral earth pressure	CE B GE SMPH
consolidation	CE B GE SMCN
compaction	CE B GE SMCO
other	CE B GE SMOT

Shallow Foundations

allowable bearing pressure	CE B GE SHPA
bearing capacity	CE B GE SHBC
settlement and consolidation	CE B GE SHST
other	CE B GE SHOT

Earth Retaining Structures

gravity walls	CE B GE ERGW
cantilever walls	CE B GE ERCW
stability analysis	CE B GE ERST
earth pressure diagrams	CE B GE ERPD
other	CE B GE EROT

STRUCTURAL (ST)— BREADTH

Loadings

dead and live	CE B ST LDDL
wind	CE B ST LDWN
snow	CE B ST LDSN
other	CE B ST LDOT

Analysis	
determinate analysis	CE B ST ANDT
shear diagrams	CE B ST ANSD
moment diagrams	CE B ST ANMD
influence diagrams	CE B ST ANIF
theory	CE B ST ANTH
other	CE B ST ANOT
Mechanics of Materials	
flexure	CE B ST MMFL
shear	CE B ST MMSH
tension and compression	CE B ST MMTC
bearing	CE B ST MMBR
deflection	CE B ST MMDF
other	CE B ST MMOT
Building Materials	
concrete mix design	CE B ST BMCM
reinforced concrete	CE B ST BMRC
structural steel	CE B ST BMST
timber	CE B ST BMTI
masonry	CE B ST BMMA
other	CE B ST BMOT
Member Design	
beams	CE B ST MDBE
slabs	CE B ST MDSL
columns	CE B ST MDCO
footings	CE B ST MDFT
retaining walls	CE B ST MDRW
trusses	CE B ST MDTR
other	CE B ST MDOT

TRANSPORTATION (TR) — BREADTH

Traffic Analysis	
capacity analysis	CE B TR TACA
other	CE B TR TAOT
Construction	
optimization	CE B TR CNOP
excavation/embankment	CE B TR CNEX
hauling/material handling	CE B TR CNHA
surfacing	CE B TR CNSU
scheduling/management	CE B TR CNSC
other	CE B TR CNOT

Geometric Design	
horizontal curves	CE B TR GDHC
vertical curves	CE B TR GDVC
sight distance	CE B TR GDS D
other	CE B TR GDOT

WATER RESOURCES (WR)—BREADTH

Hydraulics	
energy/continuity equation	CE B WR HYEN
pressure flow	CE B WR HYPF
pressure conduit	CE B WR HYPC
friction/minor losses	CE B WR HYFL
open channel flow	CE B WR HYOF
hydraulic jump	CE B WR HYHJ
culverts	CE B WR HYCU
flow/velocity measurement and control	CE B WR HYVM
flow equations	CE B WR HYFE
flow rates (domestic, irrigation, fire)	CE B WR HYFR
other	CE B WR HYOT
Runoff and Hydrology	
storm characterization	CE B WR RNST
storm frequency	CE B WR RNSF
rainfall intensity and duration	CE B WR RNRF
hydrographs	CE B WR RNHY
runoff analysis	CE B WR RNAN
runoff quantity	CE B WR RNQU
floods	CE B WR RNFL
routing	CE B WR RNRT
other	CE B WR RNOT
Water Treatment (drinking)	
quantities	CE B WR WTQU
tests and testing	CE B WR WTTE
regulations	CE B WR WTRE
unit processes	CE B WR WTUP
demands	CE B WR WTDE
hydraulic loading	CE B WR WTHL
storages (raw and treated water)	CE B WR WTST
other	CE B WR WTOT

Item Classification Codes (Civil PE—DEPTH)

ENVIRONMENTAL (EN) — DEPTH

Wastewater Treatment

unit processes	CE D EN WWUP
sludge processing	CE D EN WWSL
disinfection	CE D EN WWDI
wastewater flow rates	CE D EN WWFR
primary clarification	CE D EN WWPC
biological treatment	CE D EN WWBT
secondary clarification	CE D EN WWSC
chemical precipitation	CE D EN WWCP
digesters	CE D EN WWDG
nitrification/denitrification	CE D EN WWND
effluent limits	CE D EN WWEL
wetlands	CE D EN WWWL
operations	CE D EN WWOP
quantities	CE D EN WWQU
tests and testing	CE D EN WWTE
regulations	CE D EN WWRG
other	CE D EN WWOT

Biology

organisms (plant/animal)	CE D EN BIOR
organic load	CE D EN BIOL
indicator organisms	CE D EN BIIO
degradation of streams and lakes	CE D EN BIDE
disinfection	CE D EN BIDI
water taste and odor	CE D EN BITA
BOD	CE D EN BIBO
toxicity	CE D EN BITX
food chain	CE D EN BIFC
oxygenation/deoxygenation/oxygen sag curve	CE D EN BISC
eutrophication	CE D EN BIEU
temperature	CE D EN BITP
most probable number (MPN)	CE D EN BIPN
quality control	CE D EN BIQU
other	CE D EN BIOT

Solid/Hazardous Waste	
quantity estimates	CE D EN SWQU
collection	CE D EN SWCO
storage/transfer	CE D EN SWST
treatment	CE D EN SWTR
disposal	CE D EN SWDI
site and haul economics	CE D EN SWEC
regulations and standards	CE D EN SWRG
energy recovery	CE D EN SWER
hazardous waste systems	CE D EN SWSY
remediation	CE D EN SWRE
other	CE D EN SWOT
Groundwater and Well Fields	
groundwater flow	CE D EN GWFL
aquifers	CE D EN GWAQ
contamination	CE D EN GWCN
recharge	CE D EN GWRC
well analysis	CE D EN GWWL
water quality analysis	CE D EN GWQU
dewatering	CE D EN GWDW
subdrain systems	CE D EN GWSD
wells and well fields	CE D EN GWWE
remediation	CE D EN GWRE
other	CE D EN GWOT
GEOTECHNICAL (GE)—DEPTH	
Subsurface Exploration and Sampling	
drilling and sampling	CE D GE SEDR
soil classification	CE D GE SECL
boring log interpretation	CE D GE SEBL
in-situ testing	CE D GE SEIN
soil profile development	CE D GE SESP
other	CE D GE SEOT
Engineering Properties of Soils	
index properties	CE D GE EPIN
phase relationships	CE D GE EPPH
permeability	CE D GE EPPE
shear strength properties	CE D GE EPSH
other	CE D GE EPOT

Soil Mechanics Analysis	
pressure distribution	CE D GE SMPD
vertical pressure	CE D GE SMPV
lateral earth pressure	CE D GE SMPH
consolidation	CE D GE SMCN
compaction	CE D GE SMCO
effective and total stresses	CE D GE SMEF
pore pressure	CE D GE SMPP
slope stability	CE D GE SMSL
seepage and erosion	CE D GE SMSE
other	CE D GE SMOT
Shallow Foundations	
allowable bearing pressure	CE D GE SHPA
bearing capacity	CE D GE SHBC
settlement and consolidation	CE D GE SHST
proportioning individual/combined footings	CE D GE SHPR
mat and raft foundations	CE D GE SHMT
pavement design	CE D GE SHPV
other	CE D GE SHOT
Deep Foundations	
axial capacity of single piles and/or drilled shafts	CE D GE DFAC
lateral capacity of single piles and/or drilled shafts	CE D GE DFCL
settlement (axial deflection)	CE D GE DFAD
lateral deflection	CE D GE DFLD
pile/shaft groups—behavior	CE D GE DFPG
pile testing and dynamics	CE D GE DFPT
other	CE D GE DFOT
Earth Retaining Structures	
gravity walls	CE D GE ERGW
cantilever walls	CE D GE ERCW
stability analysis	CE D GE ERST
mechanically stabilized earth wall	CE D GE ERMS
braced and anchored excavations	CE D GE ERBA
excavations	CE D GE EREX
earth dams	CE D GE ERDM
earth pressure diagrams	CE D GE ERPD
serviceability requirements	CE D GE ERSE
other	CE D GE EROT
Seismic Engineering	
earthquake engineering fundamentals	CE D GE SZEF
liquefaction potential	CE D GE SZLP
other	CE D GE SZOT

STRUCTURAL (ST)—DEPTH

Loadings

dead and live	CE D ST LDDL
wind	CE D ST LDWD
snow	CE D ST LDSN
earthquake	CE D ST LDEQ
moving	CE D ST LDMV
repeated loads	CE D ST LDRP
other	CE D ST LDOT

Analysis

determinate analysis	CE D ST ANDT
indeterminate analysis	CE D ST ANIN
shear diagrams	CE D ST ANSD
moment diagrams	CE D ST ANMD
influence diagrams	CE D ST ANIF
theory	CE D ST AMTH
other	CE D ST ANOT

Mechanics of Materials

flexure	CE D ST MMFL
shear	CE D ST MMSH
torsion	CE D ST MMTO
tension and compression	CE D ST MMTC
bearing	CE D ST MMBR
deflection	CE D ST MMDF
combined stresses	CE D ST MMCS
other	CE D ST MMOT

Building Materials

concrete mix design	CE D ST BMCM
reinforced concrete	CE D ST BMRC
prestressed concrete	CE D ST BMPC
structural steel	CE D ST BMST
timber	CE D ST BMTI
masonry	CE D ST BMMA
composite construction	CE D ST BMCC
other	CE D ST BMOT

Member Design

beams	CE D ST MDBE
slabs	CE D ST MDL
columns	CE D ST MDL
footings	CE D ST MDFT
retaining walls	CE D ST MDRW
shear and bearing walls	CE D ST MDSB
trusses	CE D ST MDTR
braces and connections	CE D ST MDCN
pile foundations	CE D ST MDPF

other	CE D ST MDOT
Failure Analysis	
buckling	CE D ST FABU
fatigue	CE D ST FAFT
failure modes	CE D ST FAFM
other	CE D ST FAOT
Design Criteria	
UBC, BOCA, SBC, ACI, PCI, AISC, NDS, AASHTO, ASCE-7	CE D ST DCCO
other	CE D ST DCOT

TRANSPORTATION (TR) — DEPTH

Traffic Analysis	
capacity analysis	CE D TR TACA
highways	CE D TR TAHI
intersections	CE D TR TAIN
freeways	CE D TR TAFW
ramps and exchanges	CE D TR TARA
traffic signal	CE D TR TATS
speed studies	CE D TR TASS
parking operations	CE D TR TAPO
traffic volume studies	CE D TR TATV
mass transit studies	CE D TR TAMT
traffic control devices	CE D TR TATC
pedestrian facilities	CE D TR TAPF
bicycle facilities	CE D TR TABF
driver behavior/performance	CE D TR TADB
other	CE D TR TAOT
Construction	
optimization	CE D TR CNOP
mass diagrams	CE D TR CNMD
pavement design	CE D TR CNPD
excavation/embankment	CE D TR CNEX
hauling/material handling	CE D TR CNHA
surfacing	CE D TR CNSU
scheduling/management	CE D TR CNSC
other	CE D TR CNOT

Geometric Design	
superelevation	CE D TR GDSE
vertical/horizontal clearances	CE D TR GDVH
acceleration and deceleration	CE D TR GDAD
intersections/interchanges	CE D TR GDII
horizontal curves	CE D TR GDHC
vertical curves	CE D TR GDVC
spiral curves	CE D TR GDSC
sight distance	CE D TR GDSD
roadway cross sections	CE D TR GDSCS
other	CE D TR GDOT
Transportation Planning	
origin-destination studies	CE D TR TPOD
site impact analysis	CE D TR TPSI
optimization/cost analysis	CE D TR TPCA
trip generation/distribution/assignment	CE D TR TPTG
other	CE D TR TPOT
Traffic Safety	
accident analysis	CE D TR TSAA
roadside clearance analysis	CE D TR TSRC
counter-measurement development	CE D TR TSCM
economic analysis	CE D TR TSEA
conflict analysis	CE D TR TSCA
other	CE D TR TSOT

WATER RESOURCES (WR)—DEPTH

Hydraulics

quantities	CE D WR HYQU
energy/continuity equation	CE D WR HYEN
energy dissipation	CE D WR HYED
pressure flow	CE D WR HYPF
pressure conduit	CE D WR HYPC
friction/minor losses	CE D WR HYFL
open channel flow	CE D WR HYOF
culverts	CE D WR HYCU
flow/velocity measurement and control	CE D WR HYVM
detention/retention ponds	CE D WR HYDR
pump application and analysis	CE D WR HYPA
pipe network analysis	CE D WR HYPN
surface water profile	CE D WR HYSW
cavitation	CE D WR HYCA
flow equations	CE D WR HYFE
spillway capacity	CE D WR HYSP
stormwater collection	CE D WR HYST
flow rates (domestic, irrigation, fire)	CE D WR HYFR
sub- and supercritical flow	CE D WR HYSF
other	CE D WR HYOT

Runoff and Hydrology

storm characterization	CE D WR RNST
storm frequency	CE D WR RNSF
rainfall intensity and duration	CE D WR RNRF
hydrographs	CE D WR RNHY
runoff analysis	CE D WR RNAN
runoff quantity	CE D WR RNQU
floods	CE D WR RNFL
routing	CE D WR RNRT
transpiration	CE D WR RNTR
evaporation	CE D WR RNEV
permeation	CE D WR RNPR
sedimentation	CE D WR RNSD
gauging stations	CE D WR RNGS
flood plain/floodway	CE D WR RNFP
other	CE D WR RNOT

Water Treatment (drinking)

quantities	CE D WR WTQU
tests and testing	CE D WR WTTE
regulations	CE D WR WTRE
unit processes	CE D WR WTUP
disinfection	CE D WR WTDI
demands	CE D WR WTDE
hydraulic loading	CE D WR WTHL
storages (raw and treated water)	CE D WR WTST
rapid mixing	CE D WR WTRM
flocculation	CE D WR WTFL
sedimentation	CE D WR WTSE
filtration	CE D WR WTFI
applicable standards	CE D WR WTAS
other	CE D WR WTOT

Appendix D
**Description of Exam Format
and Subjects
(Civil PE)**

The NCEES Professional Engineering examination in civil engineering consists of two four-hour sessions separated by a one-hour lunch period. The morning “breadth” session is taken by all examinees. In the afternoon, the examinee will be able to select from five “depth” modules: environmental, geotechnical, structural, transportation, and water resources. (The depth modules may be referred to as “discipline specific” (or DS) modules, borrowing a term from the FE exam.) All five depth modules are present in the examination booklet for the examinee to review before making a selection. After the examinee begins working in a depth module, he or she may leave it and begin working in another module. However, the examinee won’t be given any additional time.

Both the morning and afternoon sessions contain 40 questions in multiple-choice (i.e., “objective”) format. As this is a “no-choice” exam, the examinee must answer all questions in each session correctly to receive full credit. There are no optional questions.

Exam Subjects

NCEES has published a description of the examination subjects. Regardless of the published examination structure, the exact number of questions that will appear in each subject area cannot be predicted reliably. There is no guarantee that any single subject will occur in any quantity. One reason for this is that some of the questions span several disciplines. The examinee might consider a pump selection question to come from the subject of fluids, while someone else might categorize it as engineering economics.

Table 1 is the official NCEES listing of the exam format, while Table 2 describes the subjects in detail. Most examinees find the list of subjects to be formidable in appearance. The percentage breakdowns given in Table 1 are according to NCEES, but these percentages are approximate. NCEES adds, “The examination is developed with questions that require a variety of approaches and methodologies including design, analysis, application, and operations. Some questions may require knowledge of engineering economics. These areas are examples of the kinds of knowledge that will be tested but are not exclusive or exhaustive categories.”

Table 1
Subjects on the Exam and
Approximate Percentages of Questions^a
(Civil PE)

LIST OF KNOWLEDGE CLUSTERS WITH PERCENTAGE OF QUESTIONS	AM TEST	PM TEST OPTION 1 Environmental	PM TEST OPTION 2 Geotechnical	PM TEST OPTION 3 Structural	PM TEST OPTION 4 Transportation	PM TEST OPTION 5 Water Resources
ENVIRONMENTAL (OPTION 1)	20%	65%	10%			25%
GEOTECHNICAL (OPTION 2)	20%	10%	65%	25%	15%	10%
STRUCTURAL (OPTION 3)	20%		20%	65%		
TRANSPORTATION (OPTION 4)	20%		5%	10%	65%	
WATER RESOURCES (OPTION 5)	20%	25%			20%	65%
TOTAL PERCENTAGES	100%	100%	100%	100%	100%	100%

^a Percentages of questions may be adjusted slightly in order to round the number of questions to whole numbers.

As Table 1 indicates, the subjects in morning and afternoon sessions overlap. However, the depth of required knowledge is not consistent. Table 2 provides some guidance as to what topics each of these options may include.

Table 2
Detailed Analysis of Tested Subjects
(Civil PE)

MORNING SESSION
(40 multiple-choice questions)

Environmental

Wastewater Treatment: wastewater flow rates, unit processes

Biology: toxicity, algae, stream degradation, temperature, disinfection, water taste and odor, BOD

Solid/Hazardous Waste: collection, storage/transfer, treatment, disposal, quantity estimates, site and haul economics

Groundwater and Well Fields: groundwater flow, aquifers (e.g., characterization)

Geotechnical

Subsurface Exploration and Sampling: drilling and sampling, soil classification, boring log interpretation, soil profile development

Engineering Properties of Soils: index properties, phase relationships, permeability

Soil Mechanics Analysis: pressure distribution, lateral earth pressure, consolidation, compaction

Shallow Foundations: bearing capacity, settlement, allowable bearing pressure

Earth Retaining Structures: gravity walls, cantilever walls, earth pressure diagrams, stability analysis

Structural

Loadings: dead and live loads, wind loads

Analysis: determinate analysis, shear diagrams, moment diagrams

Mechanics of Materials: flexure, shear, tension and compression, deflection

Materials: reinforced concrete, structural steel, timber, concrete mix design, masonry

Member Design: beams, slabs, columns, reinforced concrete footings, retaining walls, trusses

Transportation

Traffic Analysis: capacity analysis

Construction: excavation/embankment, material handling, optimization, scheduling

Geometric Design: horizontal curves, vertical curves, sight distance

Water Resources

Hydraulics: energy dissipation, energy/continuity equation, pressure conduit, open channel flow, flow rates, friction/minor losses, flow equations, hydraulic jump, culvert design, velocity control

Hydrology: storm characterization, storm frequency, hydrographs, rainfall intensity and duration, runoff analysis

Water Treatment: demands, hydraulic loading, storage (raw and treated water)

Table 2
(continued)

AFTERNOON SESSIONS

(All afternoon depth exams have 40 multiple-choice questions.)

Civil/Environmental Depth Exam

ENVIRONMENTAL

Wastewater Treatment: wastewater flow rates, primary clarification, biological treatment, secondary clarification, chemical precipitation, sludge systems, digesters, disinfection, nitrification/denitrification, effluent limits, wetlands, unit processes, operations

Biology (including micro and aquatic): toxicity, algae, food chain, stream degradation, organic load, oxygenation/deoxygenation/oxygen sag curve, eutrophication, temperature, indicator organisms, disinfection, water taste and odor, most probable number (MPN), BOD, quality control

Solid/Hazardous Waste: collection, storage/transfer, treatment, disposal, quantity estimates, site and haul economics, energy recovery, hazardous waste systems, applicable standards

Groundwater and Well Fields: dewatering, well analysis, water quality analysis, subdrain systems, groundwater flow, groundwater contamination, recharge, aquifers (e.g., characterization)

GEOTECHNICAL

Subsurface Exploration and Sampling: drilling and sampling procedures, soil classification, boring log interpretation, soil profile development

Engineering Properties of Soils: permeability

Soil Mechanics Analysis: compaction, seepage and erosion

WATER RESOURCES

Hydraulics: energy/continuity equation, pressure conduit, open channel flow, detention/retention ponds, pump application and analysis, pipe network analysis, flow rates (domestic, irrigation, fire), surface water profile, cavitation, friction/minor losses, flow measurement devices, flow equations, culvert design, velocity control

Hydrology: storm characterization, storm frequency, hydrograph (unit and others), transpiration, evaporation, permeation, rainfall intensity and duration, runoff analysis, gauging stations, flood plain/floodway, sedimentation

Water Treatment: demands, hydraulic loading, storages (raw and treated water), rapid mixing, flocculation, sedimentation, filtration, disinfection, applicable standards

Civil/Geotechnical Depth Exam

GEOTECHNICAL

Subsurface Exploration and Sampling: drilling and sampling procedures, in-situ testing, soil classification, boring log interpretation, soil profile development

Engineering Properties of Soils: index properties, phase relationships, shear strength properties, permeability

Soil Mechanics Analysis: effective and total stresses, pore pressure, pressure distribution, lateral earth pressure, consolidation, compaction, slope stability, seepage and erosion

Shallow Foundations: bearing capacity, settlement, allowable bearing pressure, proportioning individual/combined footings, mat and raft foundations, pavement design

Deep Foundations: axial capacity (single pile/drilled shaft), lateral capacity (single pile/drilled shaft), settlement, lateral deflection, behavior of pile/drilled shaft groups, pile dynamics and pile load tests

Earth Retaining Structures: gravity walls, cantilever walls, mechanically stabilized earth wall, braced and anchored excavations, earth dams, earth pressure diagrams, stability analysis, serviceability requirements

Seismic Engineering: earthquake fundamentals, liquefaction potential evaluation

ENVIRONMENTAL

Groundwater and Well Fields: dewatering, water quality analysis, groundwater contamination, aquifers (e.g., characterization)

STRUCTURAL

Loadings: dead and live loads, earthquake loads

Materials: concrete mix design

Member Design: reinforced concrete footings, pile foundations, retaining walls

TRANSPORTATION

Construction: excavation/embankment, pavement design

Civil/Structural Depth Exam

STRUCTURAL

Loadings: dead and live loads, moving loads, wind loads, earthquake loads, repeated loads

Analysis: determinate, indeterminate, shear diagrams, moment diagrams

Mechanics of Materials: flexure, shear, torsion, tension and compression, combined stresses, deflection

Materials: reinforced concrete, prestressed concrete, structural steel, timber, concrete mix design, masonry, composite construction

Member Design: beams, slabs, columns, reinforced concrete footings, pile foundations, retaining walls, trusses, braces and connections, shear and bearing walls

Failure Analysis: buckling, fatigue, failure modes

Design Criteria: UBC, BOCA, SBC, ACI, PCI, AISC, NDS, AASHTO, ASCE-7

GEOTECHNICAL

Subsurface Exploration and Sampling: boring log interpretation

Soil Mechanics Analysis: pressure distribution, lateral earth pressure

Shallow Foundations: bearing capacity, settlement, proportioning individual/combined footings, mat and raft foundations

Deep Foundations: axial capacity (single pile/drilled shaft), lateral capacity (single pile/drilled shaft), behavior of pile/drilled shaft groups

Earth Retaining Structures: gravity walls, cantilever walls, braced and anchored excavations, earth pressure diagrams, stability analysis

TRANSPORTATION

Construction: excavation/embankment, material handling, optimization, scheduling

Civil/Transportation Depth Exam

TRANSPORTATION

Traffic Analysis: traffic signal, speed studies, capacity analysis, intersection analysis, parking operations, traffic volume studies, mass transit studies, sight distance, traffic control devices, pedestrian facilities, bicycle facilities, driver behavior/performance

Transportation Planning: origin-destination studies, site impact analysis, capacity analysis, optimization/cost analysis, trip generation/distribution/assignment

Construction: excavation/embankment, material handling, optimization, scheduling, mass diagrams, pavement design

Geometric Design: horizontal curves, vertical curves, sight distance, superelevation, vertical/horizontal clearances, acceleration and deceleration, intersections/interchanges

Traffic Safety: accident analysis, roadside clearance analysis, counter-measurement development, economic analysis, conflict analysis

GEOTECHNICAL

Subsurface Exploration and Sampling: soil classification, boring log interpretation, soil profile development

Engineering Properties of Soils: index properties, phase relationships

Soil Mechanics Analysis: compaction, seepage and erosion

Shallow Foundations: pavement design

WATER RESOURCES

Hydraulics: open channel flow, flow rates (domestic, irrigation, fire), flow equations, culvert design, velocity control

Hydrology: rainfall intensity and duration, runoff analysis, flood plain/floodway

Civil/Water Resources Depth Exam

WATER RESOURCES

Hydraulics: spillway capacity, energy dissipation, energy/continuity equation, pressure conduit, open channel flow, detention/retention ponds, pump application and analysis, pipe network analysis, stormwater collection, flow rates (domestic, irrigation, fire), surface water profile, cavitation, friction/minor losses, sub- and supercritical flow, hydraulic jump, flow measurement devices, flow equations, culvert design, velocity control

Hydrology: storm characterization, storm frequency, hydrographs (unit and others), transpiration, evaporation, permeation, rainfall intensity and duration, runoff analysis, gauging stations, flood plain/floodway, sedimentation

Water Treatment: demands, hydraulic loading, storages (raw and treated water), rapid mixing, flocculation, sedimentation, filtration, disinfection, applicable standards

ENVIRONMENTAL

Wastewater Treatment: unit processes

Biology (including micro and aquatic): toxicity, algae, food chain, stream degradation, organic load, eutrophication, temperature, indicator organisms, disinfection, water taste and odor, most probable number (MPN), BOD, quality control

Groundwater and Well Fields: well analysis, water quality analysis, groundwater flow, groundwater contamination, recharge, aquifers (e.g., characterization)

GEOTECHNICAL

Subsurface Exploration and Sampling: soil classification, boring log interpretation, soil profile development

Engineering Properties of Soils: permeability

Soil Mechanics Analysis: seepage and erosion