NCEES Principles and Practice of Engineering
ARCHITECTURAL ENGINEERING Exam Specifications
Effective Beginning with the April 2018 Examinations

- The exam is an 8-hour open-book exam. It contains 40 multiple-choice questions in the 4-hour morning session, and 40 multiple-choice questions in the 4-hour afternoon session. Examinee works all questions.

- The exam uses the US Customary System (USCS) of units.

- The exam is developed with questions that will require a variety of approaches and methodologies, including design, analysis, and application.

- The knowledge areas specified as examples of kinds of knowledge are not exclusive or exhaustive categories.

	Approximate Number of Questions
I. Building Systems Integration	**12**

   A. Aspects of building performance that affect human comfort (e.g., vibration, noise, lighting, climate control)
   B. Building envelope analysis for integrity and efficiency
   C. Impact of one system on another (e.g., lighting load on air-conditioning system capacity)
   D. Life safety systems (e.g., generators, smoke control, exit lighting, fire alarms)
   E. Comparative systems efficiencies (including calculations for energy use and materials)
   F. Sustainability in design and construction (e.g., energy efficiency, indoor air quality, water conservation)
   G. Applicable standards, codes, and regulations (e.g., NFPA, ASHRAE, ICC, ADA)
   H. Building plans, specifications, and models

II. Electrical Systems	**22**

   A. Electrical power systems, including load flow and distribution
   B. Short circuit analysis
   C. Grounding principles
   D. Electrical construction methods and materials
   E. Overcurrent protection methods and device coordination
   F. Branch circuit and feeder conductor sizing
   G. Power factor correction
   H. Voltage drop calculations
   I. One-line diagram
   J. Fire alarm design principles
   K. Lighting calculations (e.g., LPD, zonal cavity)
   L. Lighting control
   M. Receptacle layout

III. Mechanical Systems   22

A. Heat gain and loss calculations
B. HVAC system analysis and selection (e.g., air cooled/water cooled, all air, heat pumps, split systems)
C. Energy calculations
D. Ventilation and pressurization (e.g., outside air requirements, exhaust, kitchen hoods, fume hoods, infiltration)
E. Indoor air quality
F. Air distribution
G. Psychrometrics
H. Hydronic and steam systems
I. Fan laws
J. Pump laws
K. Pressure loss calculations in ductwork and piping
L. Materials and methods (e.g., ductwork, piping materials, insulation)
M. Piping for specialty systems (e.g., fuel oil, natural gas, refrigerant)
N. Pipe expansion (e.g., expansion joints, loops, anchors)
O. Flow and riser diagrams (e.g., primary/secondary, variable primary, flow balance, hydraulic bridge location)
P. Static pressure calculations (e.g., NPSH, static height, pressure in building)
Q. Equipment selection (e.g., pumps, air handling units, chillers, boilers)
R. Sequences of operation for building controls
S. Domestic water systems (e.g., routing, sizing)
T. Sanitary waste and vent systems (e.g., routing, sizing, slope, invert)
U. Stormwater systems
V. Fire protection sprinkler and standpipe systems

IV. Structural Systems   16

A. Types of construction (e.g., structural steel, timber, concrete, masonry)
B. Component forces (e.g., tension, compression, bending, shear)
C. Structural load effects on electrical, mechanical, and structural systems (e.g., seismic, wind, thermal, vibrations)
D. Connections (e.g., bolted, welded, base plates, brackets)
E. Loads (e.g., gravity, lateral, temperature, settlement, construction)
F. Analysis of trusses, frames, and shear walls
G. Analysis of construction systems (e.g., staging, bracing, loads)
H. Analysis of stability (e.g., column buckling, beam lateral torsion buckling, static stability)
I. Analysis of deflection (e.g., bending, elongation, shortening, lateral)
J. Design of structural components (e.g., steel beam, wood column, economy)
K. Foundations (e.g., piles, piers, spread)
L. Material characteristics of steel, concrete, masonry, and timber (e.g., strength, stiffness, hardness, fatigue concerns)

V. Project Management and Construction Administration   **8**
   A. Differing site conditions
   B. Alternates (e.g., bid alternates, substitutions, prior approvals)
   C. Contract administration correspondence (e.g., request for information, architect's supplemental instruction, change order, progress report, quality control)
   D. Construction documents and the submittal process
   E. System conflict resolution
   F. Scheduling of design tasks, sequence of activities, CPM
   G. Quality control
   H. Legal issues (e.g., contracts, impact of decisions that may result in lawsuit, errors and omissions)

ARCHITECTURAL ENGINEERING Design Standards[1]

Effective Beginning with the April 2020 Examinations

ABBREVIATION	DESIGN STANDARD TITLE
IBC	*International Building Code,* 2015 edition, International Code Council, Inc.
IECC	*International Energy Conservation Code*, 2015 edition, International Code Council, Inc.
IFC	*International Fire Code*, 2015 edition, International Code Council, Inc.
IMC	*International Mechanical Code*, 2015 edition, International Code Council, Inc.
IPC	*International Plumbing Code*, 2015 edition, International Code Council, Inc.
ASHRAE	2017 *ASHRAE Handbook—Fundamentals*, American Society of Heating, Refrigerating and Air-Conditioning Engineers.
ASHRAE	2016 *ASHRAE Handbook—HVAC Systems and Equipment*, American Society of Heating, Refrigerating and Air-Conditioning Engineers.
ASHRAE	2015 *ASHRAE Handbook—HVAC Applications*, American Society of Heating, Refrigerating and Air-Conditioning Engineers.
ASHRAE	Standard 62.1–2016, *Ventilation for Acceptable Indoor Air Quality,* American Society of Heating, Refrigerating and Air-Conditioning Engineers.
ANSI/ASHRAE/IESNA	Standard 90.1—2016, *Energy Standard for Buildings Except Low-Rise Residential Buildings*, American Society of Heating, Refrigerating and Air-Conditioning Engineers.
IESNA	*The Lighting Handbook: Tenth Edition, Reference and Application,* Illuminating Engineering Society of North America.
NFPA 13	*Standard for the Installation of Sprinkler Systems*, 2016 edition, National Fire Protection Association.
NFPA 14	*Standard for the Installation of Standpipe and Hose Systems,* 2016 edition, National Fire Protection Association.
NFPA 70	*National Electric Code*, 2017 edition, National Fire Protection Association.
NFPA 72	*National Fire Alarm and Signaling Code*, 2016 edition, National Fire Protection Association.
NFPA 101	*Life Safety Code*, 2015 edition, National Fire Protection Association.
ACI 318	*Building Code Requirements for Structural Concrete*, 2014 edition, American Concrete Institute.
TMS 402/602	*Building Code Requirements and Specifications for Masonry Structures* (and related commentaries)*,* 2016, The Masonry Society.

AISC	*Steel Construction Manual*, 15th edition, American Institute of Steel Construction, Inc.
ASCE 7	*Minimum Design Loads and Associated Criteria for Buildings and Other Structures*, 2016 edition, American Society of Civil Engineers.
NDS	*National Design Specification for Wood Construction ASD*, 2018 edition, and *National Design Specification Supplement: Design Values for Wood Construction*, 2018 edition, American Wood Council, Leesburg, VA.

Notes
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. All questions use the US Customary System (USCS) of units.