NCEES Principles and Practice of Engineering
ARCHITECTURAL ENGINEERING CBT Exam Specifications
Effective Beginning October 1, 2022

- The exam topics have not changed since April 2018 when they were originally published.

- The exam is computer-based. It is closed book with electronic references. Design standards applicable to the PE Architectural Engineering exam are shown on the last page.

- Examinees have 9.5 hours to complete the exam, which contains 85 questions. The 9.5-hour time includes a tutorial and an optional scheduled break. Examinee works all questions.

- The exam uses the U.S. 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.

Number of Questions

1. **Building Systems Integration**   **11–17**
   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

2. **Electrical Systems**   **19–29**
   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

3. Mechanical Systems 19–29
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

4. Structural Systems 14–21
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)

5. Project Management and Construction Administration   **7–11**
   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)

In addition to the *PE Architectural Engineering Reference Handbook*, the following codes and standards will be supplied in the exam as searchable, electronic pdf files with links for easy navigation. This NCEES YouTube video shows how the standards will be presented on the exam. Standards will be provided as individual chapters on the exam, and only one chapter at a time can be opened and searched. This ensures the exam software runs large files effectively.

Solutions to exam questions that reference a standard of practice are scored based on this list and the revision year shown. Solutions based on other standards will not receive credit. All questions use the U.S. Customary System (USCS) of units.

NCEES does not sell design standards or printed copies of the NCEES handbook. The NCEES handbook is accessible from your MyNCEES account. Design standards are available through the publisher or a bookseller.

ABBREVIATION	DESIGN STANDARD TITLE
IBC	*International Building Code,* 2018 edition, International Code Council, Inc.
IECC	*International Energy Conservation Code*, 2018 edition, International Code Council, Inc.
IFC	*International Fire Code*, 2018 edition, International Code Council, Inc.
IMC	*International Mechanical Code*, 2018 edition, International Code Council, Inc.
IPC	*International Plumbing Code*, 2018 edition, International Code Council, Inc.
ASHRAE	Standard 62.1–2016, *Ventilation for Acceptable Indoor Air Quality,* American Society of Heating, Refrigerating and Air-Conditioning Engineers.
ASHRAE	Standard 90.1—2016, *Energy Standard for Buildings Except Low-Rise Residential Buildings*, American Society of Heating, Refrigerating and Air-Conditioning Engineers.
NFPA 13	*Standard for the Installation of Sprinkler Systems*, 2019 edition, National Fire Protection Association.
NFPA 14	*Standard for the Installation of Standpipe and Hose Systems,* 2019 edition, National Fire Protection Association.
NFPA 20	*Standard for the Installation of Stationary Pumps for Fire Protection,* 2019 edition, National Fire Protection Association.
NFPA 70	*National Electrical Code*, 2017 edition, National Fire Protection Association.
NFPA 72	*National Fire Alarm and Signaling Code*, 2019 edition, National Fire Protection Association.
NFPA 101	*Life Safety Code,* 2018 edition, National Fire Protection Association.

ACI 318   *Building Code Requirements for Structural Concrete*, 2019 edition, American Concrete Institute.

TMS 402/602   *Building Code Requirements and Specification for Masonry Structures* (and companion commentaries), 2016, The Masonry Society, Longmont, CO.

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.