Electrical PE exam

The Principles and Practice of Engineering (PE) exam tests for a minimum level of competency in a particular engineering discipline. It is designed for engineers who have gained a minimum of four years' post-college work experience in their chosen engineering discipline.

Application to the California board is not required prior to examination for NCEES exams, however some licensing boards may require you to file a separate application and pay an application fee as part of the approval process to qualify you for a seat for an NCEES exam. Your exam type, discipline, module, and/or site cannot be changed after the NCEES registration deadline. A $375 exam fee is payable directly to NCEES.

Exam schedule

The exam includes 80 questions. The exam appointment time is 9 hours and includes

- Nondisclosure agreement (2 minutes)
- Tutorial (8 minutes)
- Exam (8 hours)
- Scheduled break (50 minutes)

The depth section focuses more closely on a single area of practice (80 questions):

- PE Electrical and Computer: Computer Engineering (PDF)
- PE Electrical and Computer: Electronics, Controls, and Communications (PDF)
- PE Electrical and Computer: Power (PDF)

For details on the format and length of the exam, the topics covered, and applicable design standards, download the exam specifications (https://ncees.org/engineering/pe/). PE exam specifications and design standards are posted 6 months before the exam administration.

Reference material and exam prep

The NCEES *PE Electrical Reference Handbook* is the only reference material that can be used during the exam. You will be provided with an electronic reference handbook during the exam. For access prior to your exam, you can download a free electronic copy.

Register or log in to MyNCEES to download your free copy of the *PE Electrical Reference Handbook*.

NCEES offers a PE Electrical practice exam to familiarize you with the exam format and content, including alternative item types (AITs). These practice exams contain questions that have been used on past exams and questions written just for study materials to give you extra practice.

The *NCEES Examinee Guide* is the official guide to policies and procedures for all NCEES exams. Download your free copy to find out more about registering for exams and what to expect on exam day.

Scoring and reporting

Computer-based exam results are typically available 7–10 days after you take the exam. You will receive an email notification from NCEES with instructions to view your results in your MyNCEES account. Results include information specific to your licensing board regarding how you should proceed based on your performance.

Pass rates

The pass rates below previous paper and pencil PE examinees who took the PE for the first time.

Exam	Volume	Pass Rate	Next Open Registration	Availability
PE Electrical and Computer: Computer Engineering	34	56%	Open	Single day (see date) **October 24, 2023**
PE Electronics, Controls, and Communications	152	67%	**Open**	Single day (see date) **October 24, 2023**
PE Electrical and Computer: Power	1106	50%	Open	Registration is open and appointments are available year-round

Computer-based testing (CBT)

NCEES began the process of transitioning exams to computer-based testing (CBT) in 2011. CBT offers many benefits, such as enhanced security for exam content and more uniformity in testing conditions. For most exams, it also provides greater scheduling flexibility.

The PE-Civil CBT exam will be administered year-round. NCEES constructs these exams using a linear-on-the-fly (LOFT) algorithm. This means that all examinees for a particular exam are required to answer the same number of questions in the same topics; however, no examinees will have the same set of questions. The algorithm will assemble a unique exam within the same specification framework (i.e., the same number of questions per topic area) and the same relative level of difficulty.

CBT exams include traditional multiple-choice questions as well as alternative item types (AITs). AITs provide opportunities to assess the technical knowledge of examinees using methods not available through paper-based testing. AITs include but are not limited to the following:

- Multiple correct—allow examinees to select multiple answers
- Point and click—require examinees to click on part of a graphic to answer
- Drag and drop—require examinees to click on and drag items to match, sort, rank, or label
- Fill in the blank—provide a space for examinees to enter a response to the question
- All questions, including AITs, are scored as either correct or incorrect. There is no partial credit

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NCEES Principles and Practice of Engineering Examination

ELECTRICAL AND COMPUTER—POWER CBT Exam Specifications

Specifications Effective Beginning with the December 2020 Examination

Codes and Standards Valid through September 2023

- The exam topics have not changed since April 2018 when they were originally published.
- The PE Power exam is computer-based. It is closed book with an electronic reference. Codes and standards applicable to the PE Power exam are shown on the last page.
- Examinees have 9 hours to complete the exam, which contains 80 questions. The 9-hour time includes a tutorial and an optional scheduled break. Examinees work all questions.
- 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 questions may require knowledge of engineering economics.
- The knowledge areas specified as examples of kinds of knowledge are not exclusive or exhaustive categories.

	Number of Questions
1. General Power Engineering	**21–32**
A. Measurement and Instrumentation	4–6
1. Instrument transformers	
2. Insulation testing	
3. Ground resistance testing	
B. Applications	7–11
1. Lightning protection	
2. Surge protection	
3. Reliability	
4. Illumination/lighting and energy efficiency	
5. Demand calculations	
6. Energy management	
7. Engineering economics	
8. Grounding	
C. Codes and Standards	10–15
1. National Electrical Code (NFPA 70, NEC-2017)	
2. National Electrical Safety Code (ANSI C2, NESC-2017)	
3. Standard for Electrical Safety in the Workplace: Shock and Burns (NFPA 70E-2018)	
4. Hazardous area classification (NFPA 497-2017, 499-2017, 30B-2015)	

2. Circuits **14–21**

A. Analysis 8–12
1. Three-phase circuits
2. Symmetrical components
3. Per unit system
4. Phasor diagrams
5. Single-phase circuits
6. DC circuits
7. Single-line diagrams

B. Devices and Power Electronic Circuits 6–9
1. Battery characteristics and ratings
2. Power supplies and converters
3. Relays, switches, and ladder logic
4. Variable-speed drives

3. Rotating Machines and Electric Power Devices **14–21**

A. Induction and Synchronous Machines 7–11
1. Generator/motor applications
2. Equivalent circuits and characteristics
3. Motor starting
4. Electrical machine theory

B. Electric Power Devices 7–11
1. Transformers
2. Reactors
3. Testing
4. Capacitors

4. Transmission and Distribution (High, Medium, and Low Voltage) **21–32**

A. Power System Analysis 10–15
1. Voltage drop
2. Voltage regulation
3. Power factor correction and voltage support
4. Power quality
5. Fault current analysis
6. Transformer connections
7. Transmission line models
8. Power flow
9. Power system stability

B. Protection 11–17
1. Overcurrent protection
2. Protective relaying (e.g., differential, distance, undervoltage, pilot)
3. Protective devices (e.g., fuses, breakers, reclosers)
4. Coordination

NCEES Principles and Practice of Engineering Examination
PE ELECTRICAL AND COMPUTER—POWER Codes and Standards

Effective Beginning December 1, 2020

Codes and Standards Valid through September 2023

The following codes and standards will be supplied to examinees on exam day as an electronic pdf file in the exam if they are required to answer an exam question. 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.

STANDARD	TITLE
NFPA 30B-2015	Code for the Manufacture and Storage of Aerosol Products
NFPA 70-2017	National Electric Code®
NFPA 70E-2018	Standard for Electrical Safety in the Workplace
NFPA 497-2017	Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas
NFPA 499-2017	Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas
ANSI C2-2017	2017 National Electrical Safety Code®

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NCEES Principles and Practice of Engineering Examination
ELECTRICAL AND COMPUTER—ELECTRONICS, CONTROLS, AND COMMUNICATIONS
CBT Exam Specifications

Effective Beginning with the October 2021 Examination

- The exam topics have not changed since April 2018 when they were originally published.
- The PE Electronics, Controls, and Communications exam is computer-based. It is closed book with an electronic reference.
- Examinees have 9.5 hours to complete the exam, which contains 85 multiple-choice questions. The 9.5-hour time includes a tutorial and an optional scheduled break. Examinee works all questions.
- 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 questions may require knowledge of engineering economics.
- The knowledge areas specified as examples of kinds of knowledge are not exclusive or exhaustive categories.

	Number of Questions
1. General Electrical Engineering Knowledge	**28–42**
A. Circuit Analysis	16–24
1. Passive components	
2. Active components	
3. DC circuits	
4. AC circuits	
5. Transient analysis	
6. Power and energy calculations	
7. Battery characteristics and ratings	
B. Measurement and Instrumentation	5–8
1. Transducer characteristics	
2. Operational amplifiers	
3. System analysis	
4. System design	
C. Safety and Reliability	2–3
1. System interfaces	
2. Failure limits and circuit protection/isolation	
3. Safety grounding	
4. Electromagnetic compatibility and interference	
5. Electromagnetic exposure	
6. Reliability	
7. Electric shock and burns	

D. Signal Processing 5–8
   1. Sampling theory (aliasing, Nyquist sampling rate)
   2. Transforms and applications
   3. Analog-to-digital (A/D) and digital-to-analog (D/A) conversion
   4. Filtering

2. Digital Systems 7–11

A. Digital Logic 4–6
   1. Boolean algebra
   2. Combinational and sequential logic

B. Digital Components 3–5
   1. Digital devices
   2. Memory devices
   3. Programmable logic devices
   4. Microcontrollers/embedded systems

3. Electromagnetics 7–11

A. Electromagnetic Fields 3–5
   1. Static electric and magnetic fields
   2. Electromagnetic properties of materials (conductivity, permittivity, permeability)
   3. Electromagnetic waves and propagation
   4. Electromagnetic compatibility

B. Guided Waves 2–3
   1. Transmission lines and waveguides
   2. Optical fibers

C. Antennas 2–3
   1. Gain, patterns, and polarization
   2. Impedance
   3. Transmit/receive antenna system (e.g., link budget)

4. Electronics 14–21

A. Electronics Circuits 7–11
   1. Small-signal and large-signal models
   2. Active networks and filters
   3. Nonlinear circuits (comparator, diode, etc.)
   4. Sinusoidal steady-state analysis
   5. Transient analysis
   6. Power, energy, and heat dissipation

B. Electronic Components and Applications 7–11
   1. Diodes, transistors, and applications
   2. Solid-state power devices and power electronics applications
   3. Power supplies
   4. Oscillators and phase-locked loops
   5. Amplifiers
   6. Modulators and demodulators

5. Control Systems 7–11

A. Analysis and Design of Analog or Digital Control Systems
   1. Block diagrams and signal flow graphs
   2. Characteristic equations
   3. Frequency response
   4. Time response
   5. Control system design and implementation (e.g., compensators, steady-state error)
   6. Stability (e.g., tests, Bode plots, root locus, transport delay)

6. Communications **7–11**

A. Modulation Techniques 2–3
   1. Analog modulation
   2. Digital modulation
   3. Spread spectrum modulation

B. Noise and Interference 3–5
   1. Signal-to-noise ratio
   2. Quantization noise
   3. Noise figure and temperature
   4. Interference (e.g., jamming, spectrum allocation)
   5. Coding, error detection, and correction

C. Communication Systems 2–3
   1. Wired or optical communications
   2. Wireless communications
   3. Multiple-access techniques (TDMA, CSMA/CD, WDM, etc.)
   4. Traffic capacity analysis

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NCEES Principles and Practice of Engineering Examination

ELECTRICAL AND COMPUTER—COMPUTER ENGINEERING

CBT Exam Specifications

Effective Beginning with the October 2021 Examination

- The exam topics have not changed since April 2018 when they were originally published.
- The PE Computer Engineering exam is computer-based. It is closed book with an electronic reference.
- Examinees have 9.5 hours to complete the exam, which contains 85 multiple-choice questions. The 9.5-hour time includes a tutorial and an optional scheduled break. Examinee works all questions.
- 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 questions may require knowledge of engineering economics.
- The knowledge areas specified as examples of kinds of knowledge are not exclusive or exhaustive categories.

	Number of Questions
1. Computer Systems	**21–32**
A. Data Representation	5–8
1. Number representation	
2. Character representation	
3. Encoding schemes	
4. Error detection and correction	
5. Data compression	
6. Encryption	
B. Computer Architecture	16–24
1. Computer organization and processor design	
2. Embedded systems	
3. System architecture	
4. Memory systems	
5. System performance	
2. Embedded System Software	**14–21**
A. Systems Software	7–11
1. Operating systems	
2. Real-time operating systems	
3. Computer security	
4. Device drivers	
5. Interrupts and exception handling	
6. Firmware (e.g., BIOS)	

B. Application Development 7–11
   1. Software design
   2. Quality assurance
   3. Software fundamentals
   4. Development tools (e.g., debuggers, disassemblers, trace tools, emulators)

3. Hardware 21–32

A. Digital Devices and Systems 9–14
   1. Memory devices
   2. Standard modular devices (e.g., multiplexers)
   3. Programmable devices
   4. Serialization and deserialization
   5. Combinational and sequential circuits
   6. Implementation technology (e.g., FPGA, ASIC)
   7. Arithmetic hardware (e.g., ALU, FPU)
   8. Synchronous
   9. Asynchronous
   10. Testability
   11. Tristate logic
   12. System design (datapath/control)

B. Digital Electronics 5–8
   1. Basic solid-state devices
   2. Operating parameters
   3. Data conversion and instrumentation
   4. Circuit implementation
   5. Timing design and analysis

C. Hardware Description Languages 7–11
   1. Testbench development
   2. Abstraction levels (RTL, structural, behavioral) and hierarchical design
   3. Synthesis issues
   4. Verification (e.g., assertions, coverage)

4. Computer Networks 14–21

A. Protocols and Standards 2–3
B. Configuration/Topology 4–6
   1. Wireless
   2. Wired and optical

C. Hardware 3–5
D. Safety, Security, Privacy 3–5
E. Cyber Physical Systems 2–3
   1. Distributed sensing
   2. Self-configuration
   3. Mobile network systems