

**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 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 | |

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| 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) | |

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| 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 | |