NCEES *advancing licensure for engineers and surveyors*

NCEES Principles and Practice of Engineering Examination
ELECTRICAL AND COMPUTER—ELECTRONICS, CONTROLS, AND COMMUNICATIONS
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 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.

	Approximate Number of Questions
I. General Electrical Engineering Knowledge	**32**
A. Circuit Analysis	18
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	6
1. Transducer characteristics	
2. Operational amplifiers	
3. System analysis	
4. System design	
C. Safety and Reliability	2
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	6
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	

II. Digital Systems   **8**
   A. Digital Logic   4
      1. Boolean algebra
      2. Combinational and sequential logic
   B. Digital Components   4
      1. Digital devices
      2. Memory devices
      3. Programmable logic devices
      4. Microcontrollers/embedded systems

III. Electromagnetics   **8**
   A. Electromagnetic Fields   4
      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
      1. Transmission lines and waveguides
      2. Optical fibers
   C. Antennas   2
      1. Gain, patterns, and polarization
      2. Impedance
      3. Transmit/receive antenna system (e.g., link budget)

IV. Electronics   **16**
   A. Electronics Circuits   8
      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   8
      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

V. Control Systems   **8**
   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)

VI. Communications   **8**
  A. Modulation Techniques   2
      1. Analog modulation
      2. Digital modulation
      3. Spread spectrum modulation
  B. Noise and Interference   4
      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
      1. Wired or optical communications
      2. Wireless communications
      3. Multiple-access techniques (TDMA, CSMA/CD, WDM, etc.)
      4. Traffic capacity analysis