



**Fundamentals of Engineering (FE)
ELECTRICAL AND COMPUTER CBT Exam Specifications
Effective Beginning with the January 2014 Examinations**

- The FE exam is a computer-based test (CBT). It is closed book with an electronic reference.
- Examinees have 6 hours to complete the exam, which contains 110 multiple-choice questions. The 6-hour time also includes a tutorial and an optional scheduled break.
- The FE exam uses both the International System of Units (SI) and the US Customary System (USCS).

Knowledge	Number of Questions
1. Mathematics	11–17
A. Algebra and trigonometry	
B. Complex numbers	
C. Discrete mathematics	
D. Analytic geometry	
E. Calculus	
F. Differential equations	
G. Linear algebra	
H. Vector analysis	
2. Probability and Statistics	4–6
A. Measures of central tendencies and dispersions (e.g., mean, mode, standard deviation)	
B. Probability distributions (e.g., discrete, continuous, normal, binomial)	
C. Expected value (weighted average) in decision making	
D. Estimation for a single mean (e.g., point, confidence intervals, conditional probability)	
3. Ethics and Professional Practice	3–5
A. Codes of ethics (professional and technical societies)	
B. NCEES Model Law and Model Rules	
C. Intellectual property (e.g., copyright, trade secrets, patents)	
4. Engineering Economics	3–5
A. Time value of money (e.g., present value, future value, annuities)	
B. Cost estimation	
C. Risk identification	
D. Analysis (e.g., cost-benefit, trade-off, breakeven)	
5. Properties of Electrical Materials	4–6
A. Chemical (e.g., corrosion, ions, diffusion)	
B. Electrical (e.g., conductivity, resistivity, permittivity, magnetic permeability)	
C. Mechanical (e.g., piezoelectric, strength)	
D. Thermal (e.g., conductivity, expansion)	

6. Engineering Sciences	6–9
A. Work, energy, power, heat	
B. Charge, energy, current, voltage, power	
C. Forces (e.g., between charges, on conductors)	
D. Work done in moving a charge in an electric field (relationship between voltage and work)	
E. Capacitance	
F. Inductance	
7. Circuit Analysis (DC and AC Steady State)	10–15
A. KCL, KVL	
B. Series/parallel equivalent circuits	
C. Thevenin and Norton theorems	
D. Node and loop analysis	
E. Waveform analysis (e.g., RMS, average, frequency, phase, wavelength)	
F. Phasors	
G. Impedance	
8. Linear Systems	5–8
A. Frequency/transient response	
B. Resonance	
C. Laplace transforms	
D. Transfer functions	
E. 2-port theory	
9. Signal Processing	5–8
A. Convolution (continuous and discrete)	
B. Difference equations	
C. Z-transforms	
D. Sampling (e.g., aliasing, Nyquist theorem)	
E. Analog filters	
F. Digital filters	
10. Electronics	7–11
A. Solid-state fundamentals (e.g., tunneling, diffusion/drift current, energy bands, doping bands, p-n theory)	
B. Discrete devices (diodes, transistors, BJT, CMOS) and models and their performance	
C. Bias circuits	
D. Amplifiers (e.g., single-stage/common emitter, differential)	
E. Operational amplifiers (ideal, non-ideal)	
F. Instrumentation (e.g., measurements, data acquisition, transducers)	
G. Power electronics	
11. Power	8–12
A. Single phase and three phase	
B. Transmission and distribution	
C. Voltage regulation	
D. Transformers	
E. Motors and generators	
F. Power factor (pf)	

12. Electromagnetics	5–8
A. Maxwell equations	
B. Electrostatics/magnetostatics (e.g., measurement of spatial relationships, vector analysis)	
C. Wave propagation	
D. Transmission lines (high frequency)	
E. Electromagnetic compatibility	
13. Control Systems	6–9
A. Block diagrams (feed-forward, feedback)	
B. Bode plots	
C. Closed-loop and open-loop response	
D. Controller performance (gain, PID), steady-state errors	
E. Root locus	
F. Stability	
G. State variables	
14. Communications	5–8
A. Basic modulation/demodulation concepts (e.g., AM, FM, PCM)	
B. Fourier transforms/Fourier series	
C. Multiplexing (e.g., time division, frequency division)	
D. Digital communications	
15. Computer Networks	3–5
A. Routing and switching	
B. Network topologies/frameworks/models	
C. Local area networks	
16. Digital Systems	7–11
A. Number systems	
B. Boolean logic	
C. Logic gates and circuits	
D. Logic minimization (e.g., SOP, POS, Karnaugh maps)	
E. Flip-flops and counters	
F. Programmable logic devices and gate arrays	
G. State machine design	
H. Data path/controller design	
I. Timing (diagrams, asynchronous inputs, races, hazards)	
17. Computer Systems	4–6
A. Architecture (e.g., pipelining, cache memory)	
B. Microprocessors	
C. Memory technology and systems	
D. Interfacing	
18. Software Development	4–6
A. Algorithms	
B. Data structures	
C. Software design methods (structured, object-oriented)	
D. Software implementation (e.g., procedural, scripting languages)	
E. Software testing	