NCEES
advancing licensure for engineers and surveyors

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 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