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## 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
<b>1. Mathematics</b>	<b>11–17</b>
A. Algebra and trigonometry	
B. Complex numbers	
C. Discrete mathematics	
D. Analytic geometry	
E. Calculus	
F. Differential equations	
G. Linear algebra	
H. Vector analysis	
<b>2. Probability and Statistics</b>	<b>4–6</b>
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)	
<b>3. Ethics and Professional Practice</b>	<b>3–5</b>
A. Codes of ethics (professional and technical societies)	
B. NCEES <i>Model Law</i> and <i>Model Rules</i>	
C. Intellectual property (e.g., copyright, trade secrets, patents)	
<b>4. Engineering Economics</b>	<b>3–5</b>
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)	
<b>5. Properties of Electrical Materials</b>	<b>4–6</b>
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)	

<b>6. Engineering Sciences</b>	<b>6–9</b>
<ul style="list-style-type: none"> <li>A. Work, energy, power, heat</li> <li>B. Charge, energy, current, voltage, power</li> <li>C. Forces (e.g., between charges, on conductors)</li> <li>D. Work done in moving a charge in an electric field (relationship between voltage and work)</li> <li>E. Capacitance</li> <li>F. Inductance</li> </ul>	
<b>7. Circuit Analysis (DC and AC Steady State)</b>	<b>10–15</b>
<ul style="list-style-type: none"> <li>A. KCL, KVL</li> <li>B. Series/parallel equivalent circuits</li> <li>C. Thevenin and Norton theorems</li> <li>D. Node and loop analysis</li> <li>E. Waveform analysis (e.g., RMS, average, frequency, phase, wavelength)</li> <li>F. Phasors</li> <li>G. Impedance</li> </ul>	
<b>8. Linear Systems</b>	<b>5–8</b>
<ul style="list-style-type: none"> <li>A. Frequency/transient response</li> <li>B. Resonance</li> <li>C. Laplace transforms</li> <li>D. Transfer functions</li> <li>E. 2-port theory</li> </ul>	
<b>9. Signal Processing</b>	<b>5–8</b>
<ul style="list-style-type: none"> <li>A. Convolution (continuous and discrete)</li> <li>B. Difference equations</li> <li>C. Z-transforms</li> <li>D. Sampling (e.g., aliasing, Nyquist theorem)</li> <li>E. Analog filters</li> <li>F. Digital filters</li> </ul>	
<b>10. Electronics</b>	<b>7–11</b>
<ul style="list-style-type: none"> <li>A. Solid-state fundamentals (e.g., tunneling, diffusion/drift current, energy bands, doping bands, p-n theory)</li> <li>B. Discrete devices (diodes, transistors, BJT, CMOS) and models and their performance</li> <li>C. Bias circuits</li> <li>D. Amplifiers (e.g., single-stage/common emitter, differential)</li> <li>E. Operational amplifiers (ideal, non-ideal)</li> <li>F. Instrumentation (e.g., measurements, data acquisition, transducers)</li> <li>G. Power electronics</li> </ul>	
<b>11. Power</b>	<b>8–12</b>
<ul style="list-style-type: none"> <li>A. Single phase and three phase</li> <li>B. Transmission and distribution</li> <li>C. Voltage regulation</li> <li>D. Transformers</li> <li>E. Motors and generators</li> <li>F. Power factor (pf)</li> </ul>	

<b>12. Electromagnetics</b>	<b>5–8</b>
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	
<b>13. Control Systems</b>	<b>6–9</b>
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	
<b>14. Communications</b>	<b>5–8</b>
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	
<b>15. Computer Networks</b>	<b>3–5</b>
A. Routing and switching	
B. Network topologies/frameworks/models	
C. Local area networks	
<b>16. Digital Systems</b>	<b>7–11</b>
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)	
<b>17. Computer Systems</b>	<b>4–6</b>
A. Architecture (e.g., pipelining, cache memory)	
B. Microprocessors	
C. Memory technology and systems	
D. Interfacing	
<b>18. Software Development</b>	<b>4–6</b>
A. Algorithms	
B. Data structures	
C. Software design methods (structured, object-oriented)	
D. Software implementation (e.g., procedural, scripting languages)	
E. Software testing	