

**NCEES Fundamentals of Engineering (FE) Examination
ELECTRICAL EXAM SPECIFICATIONS**

Effective Beginning with the April 2009 Examinations

- The FE examination is an 8-hour supplied-reference examination: 120 questions in the 4-hour morning session and 60 questions in the 4-hour afternoon session.
- Examinees work all questions in the morning session and all questions in the afternoon module.
- The FE examination uses both the International System of Units (SI) and the US Customary System (USCS).

MORNING Session (120 questions in 12 topic areas)

Topic Area	Approximate Percentage of AM Test Content
I. Mathematics	15%
A. Analytic geometry	
B. Integral calculus	
C. Matrix operations	
D. Roots of equations	
E. Vector analysis	
F. Differential equations	
G. Differential calculus	
II. Engineering Probability and Statistics	7%
A. Measures of central tendencies and dispersions (e.g., mean, mode, standard deviation)	
B. Probability distributions (e.g., discrete, continuous, normal, binomial)	
C. Conditional probabilities	
D. Estimation (e.g., point, confidence intervals) for a single mean	
E. Regression and curve fitting	
F. Expected value (weighted average) in decision-making	
G. Hypothesis testing	
III. Chemistry	9%
A. Nomenclature	
B. Oxidation and reduction	
C. Periodic table	
D. States of matter	
E. Acids and bases	
F. Equations (e.g., stoichiometry)	
G. Equilibrium	
H. Metals and nonmetals	
IV. Computers	7%
A. Terminology (e.g., memory types, CPU, baud rates, Internet)	
B. Spreadsheets (e.g., addresses, interpretation, "what if," copying formulas)	
C. Structured programming (e.g., assignment statements, loops and branches, function calls)	

- V. Ethics and Business Practices** **7%**
- A. Code of ethics (professional and technical societies)
 - B. Agreements and contracts
 - C. Ethical versus legal
 - D. Professional liability
 - E. Public protection issues (e.g., licensing boards)
- VI. Engineering Economics** **8%**
- A. Discounted cash flow (e.g., equivalence, PW, equivalent annual FW, rate of return)
 - B. Cost (e.g., incremental, average, sunk, estimating)
 - C. Analyses (e.g., breakeven, benefit-cost)
 - D. Uncertainty (e.g., expected value and risk)
- VII. Engineering Mechanics (Statics and Dynamics)** **10%**
- A. Statics
 - 1. Resultants of force systems
 - 2. Concurrent force systems
 - 3. Equilibrium of rigid bodies
 - 4. Frames and trusses
 - 5. Centroid of area
 - 6. Area moments of inertia
 - 7. Friction
 - B. Dynamics
 - 1. Linear motion (e.g., force, mass, acceleration, momentum)
 - 2. Angular motion (e.g., torque, inertia, acceleration, momentum)
 - 3. Mass moments of inertia
 - 4. Impulse and momentum applied to:
 - a. particles
 - b. rigid bodies
 - 5. Work, energy, and power as applied to:
 - a. particles
 - b. rigid bodies
 - 6. Friction
- VIII. Strength of Materials** **7%**
- A. Shear and moment diagrams
 - B. Stress types (e.g., normal, shear, bending, torsion)
 - C. Stress strain caused by:
 - 1. axial loads
 - 2. bending loads
 - 3. torsion
 - 4. shear
 - D. Deformations (e.g., axial, bending, torsion)
 - E. Combined stresses
 - F. Columns
 - G. Indeterminant analysis
 - H. Plastic versus elastic deformation

- IX. Material Properties** **7%**
- A. Properties
 - 1. chemical
 - 2. electrical
 - 3. mechanical
 - 4. physical
 - B. Corrosion mechanisms and control
 - C. Materials
 - 1. engineered materials
 - 2. ferrous metals
 - 3. nonferrous metals
- X. Fluid Mechanics** **7%**
- A. Flow measurement
 - B. Fluid properties
 - C. Fluid statics
 - D. Energy, impulse, and momentum equations
 - E. Pipe and other internal flow
- XI. Electricity and Magnetism** **9%**
- A. Charge, energy, current, voltage, power
 - B. Work done in moving a charge in an electric field (relationship between voltage and work)
 - C. Force between charges
 - D. Current and voltage laws (Kirchhoff, Ohm)
 - E. Equivalent circuits (series, parallel)
 - F. Capacitance and inductance
 - G. Reactance and impedance, susceptance and admittance
 - H. AC circuits
 - I. Basic complex algebra
- XII. Thermodynamics** **7%**
- A. Thermodynamic laws (e.g., 1st Law, 2nd Law)
 - B. Energy, heat, and work
 - C. Availability and reversibility
 - D. Cycles
 - E. Ideal gases
 - F. Mixture of gases
 - G. Phase changes
 - H. Heat transfer
 - I. Properties of:
 - 1. enthalpy
 - 2. entropy

AFTERNOON Session (60 questions in 9 topic areas)

Topic Area	Approximate Percentage of PM Test Content
I. Circuits	16%
A. KCL, KVL	
B. Series/parallel equivalent circuits	
C. Node and loop analysis	
D. Thevenin/Norton theorems	
E. Impedance	
F. Transfer functions	
G. Frequency/transient response	
H. Resonance	
I. Laplace transforms	
J. 2-port theory	
K. Filters (simple passive)	
II. Power	13%
A. 3-phase	
B. Transmission lines	
C. Voltage regulation	
D. Delta and wye	
E. Phasors	
F. Motors	
G. Power electronics	
H. Power factor (pf)	
I. Transformers	
III. Electromagnetics	7%
A. Electrostatics/magnetostatics (e.g., measurement of spatial relationships, vector analysis)	
B. Wave propagation	
C. Transmission lines (high frequency)	
IV. Control Systems	10%
A. Block diagrams (feed forward, feedback)	
B. Bode plots	
C. Controller performance (gain, PID), steady-state errors	
D. Root locus	
E. Stability	
V. Communications	9%
A. Basic modulation/demodulation concepts (e.g., AM, FM, PCM)	
B. Fourier transforms/Fourier series	
C. Sampling theorem	
D. Computer networks, including OSI model	
E. Multiplexing	
VI. Signal Processing	8%
A. Analog/digital conversion	
B. Convolution (continuous and discrete)	
C. Difference equations	
D. Z-transforms	

- VII. Electronics** **15%**
- A. Solid-state fundamentals (tunneling, diffusion/drift current, energy bands, doping bands, p-n theory)
 - B. Bias circuits
 - C. Differential amplifiers
 - D. Discrete devices (diodes, transistors, BJT, CMOS) and models and their performance
 - E. Operational amplifiers
 - F. Filters (active)
 - G. Instrumentation (measurements, data acquisition, transducers)
- VIII. Digital Systems** **12%**
- A. Numbering systems
 - B. Data path/control system design
 - C. Boolean logic
 - D. Counters
 - E. Flip-flops
 - F. Programmable logic devices and gate arrays
 - G. Logic gates and circuits
 - H. Logic minimization (SOP, POS, Karnaugh maps)
 - I. State tables/diagrams
 - J. Timing diagrams
- IX. Computer Systems** **10%**
- A. Architecture (e.g., pipelining, cache memory)
 - B. Interfacing
 - C. Microprocessors
 - D. Memory technology and systems
 - E. Software design methods (structured, top-down bottom-up, object-oriented design)
 - F. Software implementation (structured programming, algorithms, data structures)