NCEES Fundamentals of Engineering (FE) Examination

CIVIL 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 A. Analytic geometry B. Integral calculus C. Matrix operations D. Roots of equations E. Vector analysis F. Differential equations G. Differential calculus	**15%**
II. Engineering Probability and Statistics 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	**7%**
III. Chemistry 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	**9%**
IV. Computers 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)	**7%**

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. Surveying	**11%**
A. Angles, distances, and trigonometry	
B. Area computations	
C. Closure	
D. Coordinate systems (e.g., GPS, state plane)	
E. Curves (vertical and horizontal)	
F. Earthwork and volume computations	
G. Leveling (e.g., differential, elevations, percent grades)	
II. Hydraulics and Hydrologic Systems	**12%**
A. Basic hydrology (e.g., infiltration, rainfall, runoff, detention, flood flows, watersheds)	
B. Basic hydraulics (e.g., Manning equation, Bernoulli theorem, open-channel flow, pipe flow)	
C. Pumping systems (water and wastewater)	
D. Municipal water distribution systems	
E. Reservoirs (e.g., dams, routing, spillways)	
F. Groundwater (e.g., flow, wells, drawdown)	
G. Sewer collection systems (storm and sanitary)	
III. Soil Mechanics and Foundations	**15%**
A. Index properties and soil classifications	
B. Phase relations (air-water-solid)	
C. Laboratory and field tests	
D. Effective stress (buoyancy)	
E. Retaining walls (e.g., active pressure/passive pressure)	
F. Shear strength	
G. Bearing capacity (cohesive and noncohesive)	
H. Foundation types (e.g., spread footings, piles, wall footings, mats)	
I. Consolidation and differential settlement	
J. Seepage	
K. Slope stability (e.g., fills, embankments, cuts, dams)	
L. Soil stabilization (e.g., chemical additives, geosynthetics)	
IV. Environmental Engineering	**12%**
A. Water quality (ground and surface)	
B. Air quality	
C. Solid/hazardous waste	
D. Sanitary sewer system loads	
E. Basic tests (e.g., water, wastewater, air)	
F. Environmental regulations	
G. Water treatment and wastewater treatment (e.g., primary, secondary, tertiary)	

V. Transportation — 12%

A. Streets and highways
   1. geometric design
   2. pavement design
   3. intersection design
B. Traffic analysis and control
   1. safety
   2. capacity
   3. traffic flow
   4. traffic control devices

VI. Structural Analysis — 10%

A. Force analysis of statically determinant beams, trusses and frames
B. Deflection analysis of statically determinant beams, trusses and frames
C. Stability analysis of beams, trusses and frames
D. Column analysis (e.g., buckling, boundary conditions)
E. Loads and load paths (e.g., dead, live, moving)
F. Elementary statically indeterminate structures

VII. Structural Design — 10%

A. Codes (e.g., AISC, ACI, NDS, AISI)
B. Design procedures for steel components (e.g., beams, columns, beam-columns, tension members, connections)
C. Design procedures for concrete components (e.g., beams, slabs, columns, walls, footings)

VIII. Construction Management — 10%

A. Procurement methods (e.g., design-build, design-bid-build, qualifications based)
B. Allocation of resources (e.g., labor, equipment, materials, money, time)
C. Contracts/contract law
D. Project scheduling (e.g., CPM, PERT)
E. Engineering economics
F. Project management (e.g., owner/contractor/client relations, safety)
G. Construction estimating

IX. Materials — 8%

A. Concrete mix design
B. Asphalt mix design
C. Test methods (e.g., steel, concrete, aggregates, asphalt)
D. Properties of aggregates
E. Engineering properties of metals