NCEES
advancing licensure for engineers and surveyors

Fundamentals of Engineering (FE)
MECHANICAL 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, a break, and a brief survey at the conclusion.
- The FE exam uses both the International System of Units (SI) and the US Customary System (USCS).

Knowledge	Number of Questions
1. Mathematics	**6–9**
A. Analytic geometry	
B. Calculus	
C. Linear algebra	
D. Vector analysis	
E. Differential equations	
F. Numerical methods	
2. Probability and Statistics	**4–6**
A. Probability distributions	
B. Regression and curve fitting	
3. Computational Tools	**3–5**
A. Spreadsheets	
B. Flow charts	
4. Ethics and Professional Practice	**3–5**
A. Codes of ethics	
B. Agreements and contracts	
C. Ethical and legal considerations	
D. Professional liability	
E. Public health, safety, and welfare	
5. Engineering Economics	**3–5**
A. Time value of money	
B. Cost, including incremental, average, sunk, and estimating	
C. Economic analyses	
D. Depreciation	
6. Electricity and Magnetism	**3–5**
A. Charge, current, voltage, power, and energy	
B. Current and voltage laws (Kirchhoff, Ohm)	
C. Equivalent circuits (series, parallel)	
D. AC circuits	
E. Motors and generators	

7. Statics **8–12**

A. Resultants of force systems
B. Concurrent force systems
C. Equilibrium of rigid bodies
D. Frames and trusses
E. Centroids
F. Moments of inertia
G. Static friction

8. Dynamics, Kinematics, and Vibrations **9–14**

A. Kinematics of particles
B. Kinetic friction
C. Newton's second law for particles
D. Work-energy of particles
E. Impulse-momentum of particles
F. Kinematics of rigid bodies
G. Kinematics of mechanisms
H. Newton's second law for rigid bodies
I. Work-energy of rigid bodies
J. Impulse-momentum of rigid bodies
K. Free and forced vibrations

9. Mechanics of Materials **8–12**

A. Shear and moment diagrams
B. Stress types (axial, bending, torsion, shear)
C. Stress transformations
D. Mohr's circle
E. Stress and strain caused by axial loads
F. Stress and strain caused by bending loads
G. Stress and strain caused by torsion
H. Stress and strain caused by shear
I. Combined loading
J. Deformations
K. Columns

10. Material Properties and Processing **8–12**

A. Properties, including chemical, electrical, mechanical, physical, and thermal
B. Stress-strain diagrams
C. Engineered materials
D. Ferrous metals
E. Nonferrous metals
F. Manufacturing processes
G. Phase diagrams
H. Phase transformation, equilibrium, and heat treating
I. Materials selection
J. Surface conditions
K. Corrosion mechanisms and control
L. Thermal failure

M. Ductile or brittle behavior
N. Fatigue
O. Crack propagation

11. Fluid Mechanics **9–14**

A. Fluid properties
B. Fluid statics
C. Energy, impulse, and momentum
D. Internal flow
E. External flow
F. Incompressible flow
G. Compressible flow
H. Power and efficiency
I. Performance curves
J. Scaling laws for fans, pumps, and compressors

12. Thermodynamics **13–20**

A. Properties of ideal gases and pure substances
B. Energy transfers
C. Laws of thermodynamics
D. Processes
E. Performance of components
F. Power cycles, thermal efficiency, and enhancements
G. Refrigeration and heat pump cycles and coefficients of performance
H. Nonreacting mixtures of gases
I. Psychrometrics
J. Heating, ventilating, and air-conditioning (HVAC) processes
K. Combustion and combustion products

13. Heat Transfer **9–14**

A. Conduction
B. Convection
C. Radiation
D. Thermal resistance
E. Transient processes
F. Heat exchangers
G. Boiling and condensation

14. Measurements, Instrumentation, and Controls **5–8**

A. Sensors
B. Block diagrams
C. System response
D. Measurement uncertainty

15. Mechanical Design and Analysis **9–14**

A. Stress analysis of machine elements
B. Failure theories and analysis
C. Deformation and stiffness
D. Springs
E. Pressure vessels
F. Beams
G. Piping

H. Bearings
I. Power screws
J. Power transmission
K. Joining methods
L. Manufacturability
M. Quality and reliability
N. Hydraulic components
O. Pneumatic components
P. Electromechanical components