NCEES
advancing licensure for engineers and surveyors

Fundamentals of Engineering (FE)
INDUSTRIAL AND SYSTEMS CBT Exam Specifications

Effective Beginning with the July 2020 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 U.S. Customary System (USCS).

Knowledge	Number of Questions
1. Mathematics	**6–9**
A. Analytic geometry (e.g., areas, volumes)	
B. Calculus (e.g., derivatives, integrals, progressions, series)	
C. Linear algebra (e.g., matrix operations, vector analysis)	
2. Engineering Sciences	**4–6**
A. Thermodynamics and fluid mechanics	
B. Statics, dynamics, and materials	
C. Electricity and electrical circuits	
3. Ethics and Professional Practice	**4–6**
A. Codes of ethics and licensure	
B. Agreements and contracts	
C. Professional, ethical, and legal responsibility	
D. Public protection and regulatory issues	
4. Engineering Economics	**9–14**
A. Discounted cash flows (e.g., nonannual compounding, time value of money)	
B. Evaluation of alternatives (e.g., PW, EAC, FW, IRR, benefit-cost)	
C. Cost analyses (e.g., fixed/variable, break-even, estimating, overhead, inflation, incremental, sunk, replacement)	
D. Depreciation and taxes (e.g., MACRS, straight line, after-tax cash flow, recapture)	
5. Probability and Statistics	**10–15**
A. Probabilities (e.g., permutations and combinations, sets, laws of probability)	
B. Probability distributions and functions (e.g., types, statistics, central limit theorem, expected value, linear combinations)	
C. Estimation, confidence intervals, and hypothesis testing (e.g., normal, t, chi-square, types of error, sample size)	
D. Linear regression (e.g., parameter estimation, residual analysis, correlation)	
E. Design of experiments (e.g., ANOVA, factorial designs)	

6. Modeling and Quantitative Analysis **9–14**

A. Data, logic development, and analytics (e.g., databases, flowcharts, algorithms, data science techniques)
B. Linear programming and optimization (e.g., formulation, solution, interpretation)
C. Stochastic models and simulation (e.g., queuing, Markov processes, inverse probability functions)

7. Engineering Management **8–12**

A. Principles and tools (e.g., planning, organizing, motivational theory, organizational structure)
B. Project management (e.g., WBS, scheduling, PERT, CPM, earned value, agile)
C. Performance measurement (e.g., KPIs, productivity, wage scales, balance scorecard, customer satisfaction)
D. Decision making and risk (e.g., uncertainty, utility, decision trees, financial risk)

8. Manufacturing, Service, and Other Production Systems **9–14**

A. Manufacturing processes (e.g., machining, casting, welding, forming, dimensioning, new technologies)
B. Manufacturing and service systems (e.g., throughput, measurement, automation, line balancing, energy management)
C. Forecasting (e.g., moving average, exponential smoothing, tracking signals)
D. Planning and scheduling (e.g., inventory, aggregate planning, MRP, theory of constraints, sequencing)
E. Process improvements (e.g., lean systems, sustainability, value engineering)

9. Facilities and Supply Chain **9–14**

A. Flow, layout, and location analysis (e.g., from/to charts, layout types, distance metrics)
B. Capacity analysis (e.g., number of machines and people, trade-offs, material handling)
C. Supply chain management and design (e.g., pooling, transportation, network design, single-level/multilevel distribution models)

10. Human Factors, Ergonomics, and Safety **8–12**

A. Human factors (e.g., displays, controls, usability, cognitive engineering)
B. Safety and industrial hygiene (e.g., workplace hazards, safety programs, regulations, environmental hazards)
C. Ergonomics (e.g., biomechanics, cumulative trauma disorders, anthropometry, workplace design, macroergonomics)

11. Work Design **7–11**

A. Methods analysis (e.g., charting, workstation design, motion economy)
B. Work measurement (e.g., time study, predetermined time systems, work sampling, standards)
C. Learning curves

12. Quality **9–14**

A. Quality management, planning, assurance, and systems (e.g., Six Sigma, QFD, TQM, house of quality, fishbone, Taguchi loss function)
B. Quality control (e.g., control charts, process capability, sampling plans, OC curves, DOE)

13. Systems Engineering, Analysis, and Design **8–12**

A. Requirements analysis and system design
B. Functional analysis and configuration management
C. Risk management (e.g., FMEA, fault trees, uncertainty)
D. Life-cycle engineering
E. Reliability engineering (e.g., MTTF, MTBR, availability, parallel and series failure)