



**Fundamentals of Engineering (FE)
INDUSTRIAL AND SYSTEMS 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 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
1. Mathematics	6–9
A. Analytic geometry	
B. Calculus	
C. Matrix operations	
D. Vector analysis	
E. Linear algebra	
2. Engineering Sciences	5–8
A. Work, energy, and power	
B. Material properties and selection	
C. Charge, energy, current, voltage, and power	
3. Ethics and Professional Practice	5–8
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	10–15
A. Discounted cash flows (PW, EAC, FW, IRR, amortization)	
B. Types and breakdown of costs (e.g., fixed, variable, direct and indirect labor)	
C. Cost analyses (e.g., benefit-cost, breakeven, minimum cost, overhead)	
D. Accounting (financial statements and overhead cost allocation)	
E. Cost estimation	
F. Depreciation and taxes	
G. Capital budgeting	
5. Probability and Statistics	10–15
A. Combinatorics (e.g., combinations, permutations)	
B. Probability distributions (e.g., normal, binomial, empirical)	
C. Conditional probabilities	
D. Sampling distributions, sample sizes, and statistics (e.g., central tendency, dispersion)	
E. Estimation (e.g., point, confidence intervals)	
F. Hypothesis testing	
G. Regression (linear, multiple)	

- H. System reliability (e.g., single components, parallel and series systems)
 - I. Design of experiments (e.g., ANOVA, factorial designs)
- 6. Modeling and Computations** **8–12**
- A. Algorithm and logic development (e.g., flow charts, pseudocode)
 - B. Databases (e.g., types, information content, relational)
 - C. Decision theory (e.g., uncertainty, risk, utility, decision trees)
 - D. Optimization modeling (e.g., decision variables, objective functions, and constraints)
 - E. Linear programming (e.g., formulation, primal, dual, graphical solutions)
 - F. Mathematical programming (e.g., network, integer, dynamic, transportation, assignment)
 - G. Stochastic models (e.g., queuing, Markov, reliability)
 - H. Simulation
- 7. Industrial Management** **8–12**
- A. Principles (e.g., planning, organizing, motivational theory)
 - B. Tools of management (e.g., MBO, reengineering, organizational structure)
 - C. Project management (e.g., scheduling, PERT, CPM)
 - D. Productivity measures
- 8. Manufacturing, Production, and Service Systems** **8–12**
- A. Manufacturing processes
 - B. Manufacturing systems (e.g., cellular, group technology, flexible)
 - C. Process design (e.g., resources, equipment selection, line balancing)
 - D. Inventory analysis (e.g., EOQ, safety stock)
 - E. Forecasting
 - F. Scheduling (e.g., sequencing, cycle time, material control)
 - G. Aggregate planning
 - H. Production planning (e.g., JIT, MRP, ERP)
 - I. Lean enterprises
 - J. Automation concepts (e.g., robotics, CIM)
 - K. Sustainable manufacturing (e.g., energy efficiency, waste reduction)
 - L. Value engineering
- 9. Facilities and Logistics** **8–12**
- A. Flow measurements and analysis (e.g., from/to charts, flow planning)
 - B. Layouts (e.g., types, distance metrics, planning, evaluation)
 - C. Location analysis (e.g., single- and multiple-facility location, warehouses)
 - D. Process capacity analysis (e.g., number of machines and people, trade-offs)
 - E. Material handling capacity analysis
 - F. Supply chain management and design
- 10. Human Factors, Ergonomics, and Safety** **8–12**
- A. Hazard identification and risk assessment
 - B. Environmental stress assessment (e.g., noise, vibrations, heat)
 - C. Industrial hygiene
 - D. Design for usability (e.g., tasks, tools, displays, controls, user interfaces)
 - E. Anthropometry
 - F. Biomechanics
 - G. Cumulative trauma disorders (e.g., low back injuries, carpal tunnel syndrome)

- H. Systems safety
- I. Cognitive engineering (e.g., information processing, situation awareness, human error, mental models)

11. Work Design **8–12**

- A. Methods analysis (e.g., charting, workstation design, motion economy)
- B. Time study (e.g., time standards, allowances)
- C. Predetermined time standard systems (e.g., MOST, MTM)
- D. Work sampling
- E. Learning curves

12. Quality **8–12**

- A. Six sigma
- B. Management and planning tools (e.g., fishbone, Pareto, QFD, TQM)
- C. Control charts
- D. Process capability and specifications
- E. Sampling plans
- F. Design of experiments for quality improvement
- G. Reliability engineering

13. Systems Engineering **8–12**

- A. Requirements analysis
- B. System design
- C. Human systems integration
- D. Functional analysis and allocation
- E. Configuration management
- F. Risk management
- G. Verification and assurance
- H. System life-cycle engineering