NCEES
advancing licensure for engineers and surveyors

Principles and Practice of Engineering Examination
INDUSTRIAL AND SYSTEMS Exam Specifications
Effective Beginning with the April 2013 Examinations

- The exam is an 8-hour open-book exam. It contains 40 multiple-choice questions in the 4-hour morning session, and 40 multiple-choice questions in the 4-hour afternoon session. Examinee works all questions.
- The exam uses both the International System of units (SI) and the US Customary System (USCS).
- The exam is developed with questions that will require a variety of approaches and methodologies, including design, analysis, and application. Some questions may require knowledge of engineering economics, probability and statistics, operations research techniques, engineering management systems, project management, and codes and standards (e.g., ISO, OSHA, MILSTD, and NIOSH).
- The knowledge areas specified as examples of kinds of knowledge are not exclusive or exhaustive categories.

		Approximate Number of Questions
I.	**Systems Definition, Analysis, and Design**	**16**
	A. System analysis and design tools (e.g., flowcharts, Pareto charts, affinity diagrams, nominal group technique, input/output analysis)	
	B. Requirements analysis (e.g., value stream mapping)	
	C. Performance measures and applications (e.g., leading, lagging, structure)	
	D. Modeling techniques (e.g., simulations, queuing, linear programming, Markov chains)	
	E. Process types (e.g., discrete versus continuous, manufacturing, service)	
	F. Model interpretation (e.g., sensitivity analysis)	
	G. Model verification	
	H. Model validation	
	I. Bottleneck analysis (e.g., theory of constraints)	
	J. Value analysis and engineering (e.g., risk analysis)	
	K. Project management and planning (e.g., PERT/CPM; balancing risk, cost, scope, and time; Gantt charts)	
II.	**Facilities Engineering and Planning**	**16**
	A. Process flow	
	B. Network optimization	
	C. Layout design techniques (e.g., systematic layout planning [SLP], affinity diagram, relationship diagrams, center of gravity rule)	
	D. Space analysis (e.g., equipment needs, demand, location, footprint of the equipment/WIP sizing)	

E. Capacity analysis (e.g., calculation of personnel requirements, calculation of machine requirements)
F. Cost-benefit analysis
G. Site selection factors
H. Site selection methods (e.g., prioritization, factor weighting)
I. Unit load analysis
J. Life cycle cost analysis (e.g., acquisition, implementation, sustainment, retirement)
K. Material handling techniques and equipment (e.g., conveyors, industrial trucks, manual, overhead crane)

III. Supply Chain and Logistics 16

A. Forecasting methods (e.g., exponential smoothing, moving averages, seasonal)
B. Production planning methods (e.g., aggregate, MRP, MRPII, ERP, JIT, Kanban, lean manufacturing)
C. Engineering economics (e.g., break-even analysis, technical capability assessment, ROI)
D. Costing systems (e.g., activity-based costing including cost drivers, guidelines for overhead)
E. Production scheduling methods (e.g., shortest processing time first, due date order)
F. Inventory management and control
G. Distribution methods (e.g., transshipment, routing)
H. Storage and warehousing methods
I. Transportation modes (e.g., truckload [TL], less than truckload [LTL], air, rail, ship, special requirements)

IV. Work Design 16

A. Motion economy rules (e.g., therbligs)
B. Line balancing
C. Work measurement systems techniques (e.g., stopwatch, predetermined time systems, proprietary process determined time system)
D. Time-study techniques (e.g., motion study, man-machine charts, predetermined time systems)
E. Time-standard tools (e.g., learning curve, training program)
F. Sample size calculations
G. Observation frequency methods
H. Work sampling analysis
I. Safety codes, standards, and voluntary guidelines (e.g., ANSI, OSHA, MIL STD, NIOSH)
J. Methods for quantifying risk factors (e.g., NIOSH lifting equation, OSHA limits for noise)
K. Coefficient of friction (slip resistance)
L. Rapid upper limb assessment (RULA)
M. Limits of human capacity
N. Lifting aids (e.g., gait belts, cranes)
O. Link analysis and associated criteria (e.g., importance, frequency of use)

P. Workplace design/human–computer interaction (e.g., use of anthropometric data)
Q. Days Away, Restricted, and Transferred (DART) rate calculations (e.g., injury/illness incident rate and/or the management of the information required to calculate this rate)

V. Quality Engineering 16

A. Statistical process control (e.g., control chart construction and interpretation)
B. Process capability analysis (e.g., Cpk, Cp)
C. Acceptance sampling (e.g., single sampling, double sampling, MIL STD 105E, Dodge Romig, OC-curves)
D. Continuous improvement methods (e.g., Deming, Kaizen, TQM, Six Sigma)
E. Techniques for process improvement (e.g., design of experiments [DOE], Taguchi, FMEA)
F. Reliability analysis
G. Maintenance procedures (e.g., reactive, preventive, predictive)
H. Quality management system (e.g., ISO9000, benchmarking)
I. Root cause analysis