INDUSTRIAL ENGINEERING

Industrial Engineering Courses

I E 151. Computational Methods in Industrial Engineering
3 Credits (3)
History, social implications, and application of computers and an introduction to computer programming, word processing, and database management systems. Satisfies General Education computer science requirement.
Prerequisite: MATH 1220G.

I E 200. Special Problems-Sophomore
1-3 Credits
Directed individual projects. May be repeated for a total of 3 credits.
Prerequisite: consent of faculty member.

I E 217. Manufacturing Processes
3 Credits (3)
Introduction to manufactuing and processing, including: casting, forming, and machining. Emphasis on creating products with the appropriate techniques. Crosslisted with: E T 217.
Prerequisite: E T 110 and MATH 1220G.
Learning Outcomes
1. Various

I E 300. Special Problems-Junior
1-3 Credits
Directed individual projects. May be repeated for a total of 3 credits.
Prerequisite: consent of faculty member.

I E 311. Engineering Data Analysis
3 Credits (3)
Methodology and techniques associated with identifying and analyzing industrial data.
Prerequisite: C- or better in MATH 1521G or MATH 1521H or ENGR 190.
Learning Outcomes
1. Ability to correctly interpret statistical reports
2. Ability to correctly identify and solve problems involving continuous and discrete probability and random variables.
3. Ability to correctly analyze random samples using methods that include: point estimates, confidence intervals, tests of hypothesis, analysis of variance (ANOVA), and linear regression.

I E 316. Methods Engineering
3 Credits (2+3P)
Methods analysis and design. Work measurement techniques. Job evaluation and wage incentive methods. May be repeated up to 3 credits.
Prerequisite(s): I E 217, I E 311, E T 110.

I E 351. Applied Problem Solving in Industrial Engineering
3 Credits (3)
Application of computational techniques to engineering problems including the use of commercial programs in statistics and applied mathematics. Restricted to majors.
Corequisite(s): I E 311.

I E 365. Quality Control
3 Credits (3)
Statistical analysis of quality in manufacturing. Acceptance sampling and control charts.
Prerequisite: I E 311 or equivalent.

I E 375. Manufacturing Processes II
3 Credits (3)
Review of basic manufacturing processes. Advanced topics in casting, forming, machining and joining; major process parameters; economics of processes.
Prerequisite: I E 217 or E T 217.

I E 382. Business for the Practicing Engineer
3 Credits (3)
Business tools and skills, including technology commercialization, patent applications, preparing a technology-oriented business plan, reading and constructing financial documents, modeling and understanding markets, e-commerce, QFD, concurrent engineering, engineer s role in the global economy, and engineer's impact on product design and cost.
Prerequisite: engineering major, junior level or above.

I E 400. Undergraduate Research
1-3 Credits
May be repeated for a maximum of 6 credits.
Prerequisite: consent of faculty member.

I E 411. Occupational Safety
3 Credits (3)
Practical methods to improve safety in the workplace. Topics include OSHA and other regulations, hazard recognition, assessment and control, industry standards, risk assessment and safety management. Material is applicable to a variety of workplace settings. This course is intended for College of Engineering students who have completed their lower-division requirements in mathematics, engineering, technology, and basic science. Same as I E 561 with differential assignments. Prerequisite: Junior standing

I E 413. Engineering Operations Research I
3 Credits (3)
Deterministic operations research modeling including linear and integer programming.
Prerequisite: MATH 1521G or MATH 1521H or ENGR 190.
Corequisite: MATH 480.
Learning Outcomes
1. Ability to model optimization problems that can be solved by linear optimization.
2. Ability to solve linear optimization problems
3. Ability to interpret solutions of linear optimization problems in the context of the larger problem.

I E 423. Engineering Operations Research II
3 Credits (3)
Probabilistic operations research modeling, including queuing systems and their optimization; Markov chains. May be repeated up to 3 credits.
Prerequisite(s): I E 311.
Corequisite(s): MATH 392.

I E 424. Manufacturing Systems
3 Credits (3)
Organization and functions of manufacturing planning and control systems including forecasting, MRP, capacity planning, JIT systems, scheduling, and inventory control.
Prerequisite: I E 311.

I E 451. Engineering Economy
3 Credits (3)
Discounted cash flows, economics of project, contract and specifications as related to engineering design.

I E 456. Large Scale Systems Engineering
3 Credits (3)
Systems engineering approaches to large-scale complex technological and societal problems. Concepts of interaction and structural graphs, matrices, delta, and Gantt charts. The hall matrix approach, structural concepts, reachability matrices, and cross impact-analysis, modeling and decision making. May be repeated up to 3 credits.
Learning Outcomes
1. Ability to describe the systems engineering standards and best practices
2. Ability to characterize the limitations of the way that current systems engineering is practiced in terms of dealing with lifecycle uncertainty.

I E 459. Systems Thinking and Decision Making
3 Credits (3)
A general introduction to systems engineering. Topics include General Systems Theory, Systems Thinking and emerging concepts, Systems Dynamics approaches for modelling and analyzing non-linear feedback mechanisms in complex systems, and Complexity science and complex adaptive systems. May be repeated up to 3 credits.
Learning Outcomes
1. Ability to understand the complexities of engineering systems, and the implications of change on system behavior
2. Ability to understand the nature of complex systems in respect to people, processes, the environment and development organization
3. Ability to understand Systems Thinking's' role and value within organizations
4. Ability to recognize the advantages, as well as the flaws of our present predominant way of thinking (Cartesian), while looking at the changes that would enable us to deal with complex issues in daily practice (Systems Thinking)
5. Ability to recognize the value and limitations of modeling and simulation as well as how to construct and interpret various models to support decision making.

I E 460. Evaluation of Engineering Data
3 Credits (3)
Analysis of engineering systems possessing variability, employing regression, analysis of variance, distribution theory, and experimental design methods.
Prerequisite: I E 311 or equivalent.

I E 466. Reliability
3 Credits (3)
Application of statistical theory to engineering reliability estimation, reliability improvement, and the analysis of reliability test data.
Prerequisite: I E 311 or equivalent.

I E 467. Discrete-Event Simulation Modeling
3 Credits (3)
Basic modeling concepts, organizations of simulations, input data analysis, random variate generation, simulation design and analysis, model validation, output analysis, and management of simulations. Differentiated graduate assignments. May be repeated up to 3 credits.
Prerequisite(s): I E 311 or equivalent.

I E 468. Advanced Discrete-Event Simulation Applications
3 Credits (3)
Semester long project involving development and application of advanced simulation skills. May be repeated up to 3 credits.
Prerequisite: I E 467.
Learning Outcomes
1. Ability to understand the techniques of computer simulation modeling in the context of hierarchy of knowledge about a system and develop the capability to apply the same to study systems through available computer simulation software

I E 478. Facilities Planning and Design
3 Credits (3)
Plant location methods, total process analysis, process integration, materials handling analysis, and traditional and computerized plant layout methodologies.
Prerequisite(s): I E 316.
Prerequisite(s)/Corequisite(s): I E 424.

I E 480. Senior Design
3 Credits (2+3P)
Multi-disciplinary team design project for external clients. Involves semester long activities including major design report and presentation.
Prerequisites: senior standing, I E 467.

I E 490. Selected Topics
1-3 Credits
May be repeated for a maximum of 9 credits.
Prerequisite: consent of the head of the department.

I E 505. Directed Readings
1-3 Credits
May be repeated for a maximum total of 6 credits.
Prerequisite: consent of the head of the department.

I E 511. Survey of Industrial Engineering
3 Credits (3)
A project-based course covering methods of engineering, plant layout, production and inventory control, economic analysis, etc. May be repeated up to 3 credits.
Learning Outcomes
1. Ability to apply the various techniques of Industrial Engineering to solve real-life problems

I E 515. Stochastic Processes Modeling
3 Credits (3)
Introduction to the use of stochastic processes in the modeling of physical and natural systems. Use of generating functions, conditional probability and expectation, Poisson processes, random walk models, Markov chains, branching processes, Markov processes, and queuing processes in an applied setting.
Prerequisites: I E 311 or equivalent; and MATH 392 or equivalent.

I E 522. Queuing Systems
3 Credits (3)
Elements and classification of queuing systems, single server models, multi-server models, cost analysis and applications.
Learning Outcomes
1. Ability to model, analyze, and apply solutions to problems involving queueing systems
2. Ability to read and understand literature in the queueing system analysis field.

I E 523. Advanced Engineering Economy
3 Credits (3)
Theoretical basis for engineering economy methods, problems of cost estimation, replacement, nonmonetary factors, and feasibility studies. Same as C E 523.

I E 524. Advanced Production and Inventory Control
3 Credits (3)
Organization and functions of manufacturing planning and control systems including forecasting, MRP, capacity planning, JIT systems, scheduling and inventory control. Same as I E 424 with differentiated assignments.

I E 525. Systems Synthesis and Design
3 Credits (3)
Examination of the production management complex in terms of its components and the synthesis of these components into an effective operating unit. Development of input-output models representing the basis structure of all production activities.

I E 530. Environmental Management Seminar
1 Credit (1)
Survey of practical and new developments in hazardous and radioactive waste management provided through a series of guest lectures and reports of ongoing research. Same as C E 530, E E 530, CHME 530.

I E 533. Linear Programming
3 Credits (3)
Linear programming problem formulation, simplex algorithm, theory of linear programming, duality, revised simplex algorithm, and sensitivity analysis.

I E 534. Nonlinear Programming
3 Credits (3)
Theoretical and computational methods to solve optimization problems in engineering, statistics, economics, and operations research. Topics include convexity, optimality conditions, Newton's method, Lagrange multipliers, search algorithms for unconstrained and constrained problems, as well as barrier and penalty methods.
Learning Outcomes
1. Ability to model situations which may be solved by nonlinear optimization and to interpret the results in the context of the larger problem
2. Ability to employ several computer tools to correctly solve nonlinear optimization problems.
3. Ability to read and understand literature in the field of nonlinear optimization
4. Ability to select appropriate methods and algorithms from a core representative set of methods and tools to solve nonlinear optimization problems

I E 535. Discrete Optimization
3 Credits (3)
Combinatorial Optimization problems using both integer programming and graph theoretic approaches. Emphasis on modeling and computational algorithms.

I E 537. Large Scale Systems Engineering
3 Credits (3)
Systems engineering approaches to large-scale complex technological and societal problems. Concepts of interaction and structural graphs, matrices, delta, and Gantt charts. The hall matrix approach, structural concepts, reachability matrices, and cross impact-analysis, modeling and decision making.

I E 545. Characterizing Time-Dependent Engineering Data
3 Credits (3)
Theory and techniques employed in the characterization of stochastic processes commonly found in engineering applications. Distribution models include exponential, gamma, Weibull, and extreme value. Design and analysis of experiments involving complete and censored data and elevated stress. Analytical techniques include parametric, nonparametric, and graphical approaches with emphasis on modern computer tools. Exact and approximate maximum-likelihood techniques are stressed.
Learning Outcomes
1. Ability to characterize a process, based on data that is time-dependent or sequential in nature.

I E 561. Advanced Safety Engineering
3 Credits (3)
Regulation as well as qualitative, and quantitative methods to achieve and maintain safety in the workplace. Includes liability, worker's compensation, OSHA, hazard control, safety assessment, cost justification, and system analysis.
Prerequisite: graduate status in engineering.

I E 563. Topics in Engineering Administration
3 Credits (3)
Study of qualitative and quantitative aspects. Consideration given to philosophical, psychological, political and social implications of engineering administrative decisions.

I E 567. Design and Implementation of Discrete-Event Simulation
3 Credits (3)
Basic modeling concepts, organizations of simulations, input data analysis, random variate generation, simulation design and analysis, model validation, output analysis, and management of simulations. Taught with I E 467 with differentiated assignments for graduate students.

I E 571. Advanced Quality Control
3 Credits (3)
Advanced topics in quality control and design of experiments for improvement of quality.
Prerequisite: I E 311 or equivalent.

I E 575. Advanced Manufacturing Processes
3 Credits (3)
Covers major process parameters in casting, forming, machining, and joining. Process economics and selection of processes design and interactions.
Prerequisite: graduate standing.

I E 590. Selected Topics
1-3 Credits
May be repeated for a maximum of 9 credits.
Prerequisite: consent of the head of the department.

I E 598. Special Research Programs
1-3 Credits
Individual analytical or experimental investigations. May be repeated for a maximum total of 6 credits.
Prerequisite: consent of instructor.

I E 599. Master's Thesis
1-15 Credits
Thesis.

I E 610. Topics in Operations Research
3 Credits (3)
Selected topics of current interest, to be designated by subtitle. May be repeated for a maximum of 6 credits.

I E 620. Topics in Computer Modeling
3 Credits (3)
Selected topics of current interest, to be designated by subtitle. May be repeated for a maximum of 6 credits.

I E 630. Topics in Engineering Management
3 Credits (3)
Selected topics of current interest, to be designated by subtitle. May be repeated for a maximum of 6 credits.

I E 690. Selected Topics
1-15 Credits
May be repeated.
Prerequisite: consent of department head.

I E 700. Doctoral Dissertation
15 Credits
Dissertation.