INDUSTRIAL AND ENTERPRISE SYSTEMS ENGINEERING

Undergraduate Program Office: 104 Transportation Building
Fax: (217) 244-5705

Part of a nationally top-ranked engineering college on a premier Big Ten university campus, the Department of Industrial & Enterprise Systems Engineering offers students a blend of intellectual challenge, excitement, and energy that is transformational—this is a campus where you can learn from a world-renowned faculty, study in the most technologically advanced engineering library in the nation, and contribute to research that has real impact. The University attracts the best students from across the country and around the world. You can choose from about 4,000 courses as well as a variety of sports, the arts, and student activities—you'll never lack amazing things to do.

You can explore your personal interests and goals in more than 50 professional and honor engineering societies, or the more than 1,000 other organizations across campus. These student-run groups offer opportunities to develop leadership skills, test technical competence, and serve society through volunteer projects.

Many students choose a study-abroad experience to gain a better understanding of other cultures, while also developing skills that make them more marketable in the global workplace. The Office of International Programs in Engineering coordinates travel and fellowships to countries all over the world. Engineering at Illinois is the only U.S. institution to offer an international minor in engineering as part of a regular degree program.

• Major in General Engineering (http://catalog.illinois.edu/undergraduate/engineer/departments/ind-gen-engin/gen-engin)
• Major in Industrial Engineering (http://catalog.illinois.edu/undergraduate/engineer/departments/ind-gen-engin/ind-engin)

GE Class Schedule (https://courses.illinois.edu/schedule/DEFAULT/DEFAULT/GE)

General Engineering Courses

GE 100 Introduction to ISE credit: 1 Hour.
Overview of the engineering profession, the Industrial & Enterprise Systems Engineering Department, and the curricula in General Engineering and Industrial Engineering.

GE 101 Engineering Graphics & Design credit: 3 Hours.
Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques. Team design project. Credit is not given for both GE 101 and ME 170.

GE 199 Undergraduate Open Seminar credit: 1 to 5 Hours.
May be repeated.
GE 397  Independent Study  credit: 1 to 4 Hours.
Individual investigations or studies of any phase of General Engineering selected by the students and approved by the department. May be repeated in same term. Prerequisite: Consent of instructor.

GE 398  Special Topics  credit: 1 to 4 Hours.
Subject offerings of new and developing areas of knowledge in general engineering intended to augment the existing curriculum. See Class Schedule or departmental course information for topics and prerequisites. May be repeated in the same or separate terms if topics vary to a maximum of 9 hours.

GE 400  Engineering Law  credit: 3 Hours.
Nature and development of the legal system; legal rights and duties important to engineers in their professions; contracts, uniform commercial code and sales of goods, torts, agency, worker’s compensation, labor law, property, environmental law, intellectual property. 3 undergraduate hours. No graduate credit. Prerequisite: RHET 105.

GE 402  Comp-Aided Product Realization  credit: 3 Hours.
Computer-aided design, analysis, and prototyping tools used in the produce development process. Principles of computer graphics and geometric modeling, including transformations, coordinate systems, parametric solid modeling, spline curves, and surface modeling. Finite element and kinematics analyses. Rapid prototyping, product dissection, CAD-CAM-CAE operability issues, and CAD collaboration tools. 3 undergraduate hours. 3 graduate hours. Prerequisite: GE 101 and GE 311.

GE 410  Component Design  credit: 3 Hours.
Design of basic engineering components: structural members, machine parts, and connections. Principles applied include: material failure (yield, fracture, fatigue); buckling and other instabilities; design reliability; analytical simulation. 3 undergraduate hours. No graduate credit. Prerequisite: GE 311 and GE 320.

GE 411  Reliability Engineering  credit: 3 or 4 Hours.
Concepts in engineering design, testing, and management for highly reliable components and systems. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: IE 300.

GE 412  Nondestructive Evaluation  credit: 3 or 4 Hours.
Nondestructive Evaluation (NDE) principles and the role of NDE in design, manufacturing, and maintenance. Primary Nondestructive Testing and Evaluation (NDT&E) techniques, introduced from the fundamental laws of physics, including visual, ultrasonic, acoustic emission, acousto-ultrasonic, radiology, electro-magnetic, eddy-current, penetrant, thermal, and holographic. Industrial applications of probability of flaw detection, material properties characterization, impact and fatigue damage evaluation, adhesion, etc. Current literature. Prerequisite: CEE 300.

GE 413  Engrg Design Optimization  credit: 3 Hours.
Application of optimization techniques to engineering design problems. Emphasis on problem formulation, including applications in structural, mechanical, and other design domains. Important theoretical results and numerical optimization methods. Matlab programming assignments to develop software for solving nonlinear mathematical programming problems. 3 undergraduate hours. 3 graduate hours. Prerequisite: MATH 241 and MATH 415.

GE 420  Digital Control Systems  credit: 4 Hours.
Theory and techniques for control of dynamic processes by digital computer; linear discrete systems, digital filters, sampling signal reconstruction, digital design, state space methods, computers, state estimators, and laboratory techniques. 4 undergraduate hours. 4 graduate hours. Prerequisite: GE 320.

GE 422  Robot Dynamics and Control  credit: 4 Hours.
Fundamental concepts and analytical methods for analysis and design of robot systems. Laboratory experiments complement theoretical development. Same as ECE 489 and ME 446. Prerequisite: GE 320. Recommended: ECE 470.

GE 423  Mechatronics  credit: 3 Hours.
Mechatronics concepts and practice: computer interfacing of physical devices (sensors, actuators); data acquisition; real time programming and real time control; human-machine interfaces; design principles of mechatronics in manufacturing systems and in consumer systems. 3 undergraduate hours. 3 graduate hours. Prerequisite: GE 320.

GE 424  State Space Design for Control  credit: 3 Hours.
Design methods; time domain modeling; trajectories and phase plane analysis; similarity transforms; controllability and observability; pole placement and observers; linear quadratic optimal control; Lyapunov stability and describing functions; simulation. 3 undergraduate hours. 3 graduate hours. Prerequisite: GE 320 and MATH 415.

GE 450  Decision Analysis I  credit: 3 or 4 Hours.
Rules of thought that transform complex decision situations into simpler ones where the course of action is clear. Practical application of decision analysis in large organizations; methods to generate insights into real-life decision problems, avoid the common pitfalls in decision processes, and overcome the possible barriers to implementing a high-quality decision-making process for individual and organizational decision making, graphical representations of decision problems such as decision diagrams and utility diagrams. 3 or 4 undergraduate hours. 3 or 4 graduate hours. Prerequisite: IE 300.

GE 452  Leading Sustainable Change  credit: 3 Hours.
Theories and process of change; systems thinking concerning change consequences; building coalitions and communities to support change; implementing and managing projects effectively. Processes to plan, implement, manage, and sustain change with an organization through alignment of change strategies with organizational and individual concerns. 3 undergraduate hours. 3 graduate hours.

GE 494  Senior Engineering Project I  credit: 3 Hours.
Senior engineering project - team component. Student teams of three or four, guided by faculty advisors, develop solutions to real-world engineering problems provided by industry-partnering companies, subject to realistic constraints and supported by economic analyses and recommendations for implementation. Prototype solutions fabricated where practical. Multiple reports and presentations throughout the term. Several trips to company typical. Common project grade for all team members. GE 494 and GE 495 taken concurrently fulfill the Advanced Composition Requirement. Approval of the department is required to register. 3 undergraduate hours. No graduate credit. Prerequisite: GE 311, IE 300, IE 310, and TAM 335; or IE 430, IE 310, IE 311, and IE Technical Elective; credit or concurrent registration in a GE Design Elective and IE Engineering Science Elective. Must enroll concurrently in GE 495. This course satisfies the General Education Criteria for: UIUC: Advanced Composition

GE 495  Senior Engineering Project II  credit: 2 Hours.
Adjoint to GE 494. Senior engineering project – individual component. Individual grade for each team member. GE 494 and GE 495 taken concurrently fulfill the Advanced Composition Requirement. 2 undergraduate hours. No graduate credit. Prerequisite: Concurrent registration in GE 494. This course satisfies the General Education Criteria for: UIUC: Advanced Composition

Information listed in this catalog is current as of 06/2016
Industrial Engineering Courses

IE 199 Undergraduate Open Seminar  credit: 1 to 5 Hours.
May be repeated.

IE 297 Independent Study  credit: 1 to 4 Hours.
Individual investigations of any phase of Industrial Engineering. May be repeated in separate terms. Prerequisite: Consent of instructor.

IE 300 Analysis of Data  credit: 3 Hours.
Nature of probabilistic models for observed data; discrete and continuous distribution function models; inferences on universe parameters based on sample values; control charts, acceptance sampling, and measurement theory. Credit is not given for both IE 300 and CEE 202. Prerequisite: MATH 241.

IE 310 Operations Research  credit: 3 Hours.
Deterministic and stochastic models in operations research. Linear programming, integer programming, network models and nonlinear programming, review of basic probability, Bernoulli processes, Markov chains, Markov processes, and queuing theory. Credit is not given for both IE 310 and CEE 201. Prerequisite: Credit or concurrent registration in MATH 415.

IE 311 Operations Research Lab  credit: 1 Hour.
Applications of OR models with the use of software tools. Prerequisite: Concurrent registration in IE 310.

IE 330 Industrial Quality Control  credit: 3 Hours.
Contemporary concepts and methods for quality and productivity design and improvement; philosophies of Deming, Taguchi, and others leading the quality management and engineering movement; Shewhart’s methods for statistical process control; process capability analysis; statistical methods for tolerance assessment; process control methods employing attribute data; design of experiments, concepts, and methods. Prerequisite: IE 300.

IE 340 Human Factors  credit: 4 Hours.
Introduction to human factors, ergonomics, engineering psychology, history of ergonomics, human-machine relations, displays and controls, human-computer interaction, industrial and aviation systems, physiology of work and anthropometrics, cognitive ergonomics, human reliability, human as manual controller, human-machine systems design, prototyping, professional practice and ethics, laboratory exercises. Same as PSYC 358. Prerequisite: PSYC 100, PSYC 103, or consent of instructor.

IE 360 Facilities Planning and Design  credit: 3 Hours.
Facility planning, plant layout design, and materials handling analysis; determination of facilities requirements, site selection, materials flow, use of analytical and computerized techniques including simulation, and applications to areas such as manufacturing, warehousing, and office planning. Prerequisite: IE 310.

IE 361 Production Planning & Control  credit: 3 Hours.
Scope of production systems and activities involved in their design, establishment, management, operation, and maintenance; mathematical and computer models for planning and control of facilities, human resources, projects, products, material, and information in production systems. Prerequisite: IE 310.

IE 397 Independent Study  credit: 1 to 4 Hours.
Individual investigations or studies of any phase of Industrial Engineering. May be repeated in separate terms. Prerequisite: Consent of instructor.

IE 398 Special Topics  credit: 1 to 4 Hours.
Subject offerings of new and developing areas of knowledge in industrial engineering intended to augment the existing curriculum. See Class Schedule or departmental course information for topics and prerequisites. May be repeated in the same or separate terms if topics vary.

IE 400 Design & Analysis of Experiments  credit: 3 or 4 Hours.
Concepts and methods of design of experiments for quality design, improvement and control. Simple comparative experiments, including concepts of randomization and blocking, and analysis of variance techniques; factorial and fractional factorial designs; Taguchi’s concepts and methods; second-order designs; response surface methodology. Engineering applications and case studies. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: IE 300.

IE 410 Stochastic Processes & Applications  credit: 3 or 4 Hours.
Modeling and analysis of stochastic processes. Transient and steady-state behavior of continuous-time Markov chains; renewal processes; models of queuing systems (birth-and-death models, embedded-Markov chain models, queuing networks); reliability models; inventory models. Familiarity with discrete-time Markov chains, Poisson processes, and birth-and-death processes is assumed. Same as CS 481. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: IE 310.

IE 411 Optimization of Large Systems  credit: 3 or 4 Hours.
Practical methods of optimization of large-scale linear systems including extreme point algorithms, duality theory, parametric linear programming, generalized upper bounding technique, price-directive and resource-directive decomposition techniques, Lagrangian duality, Karmarkar’s algorithm, applications in engineering systems, and use of state-of-the-art computer codes. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: IE 310 and MATH 415.

IE 412 OR Models for Manufacturing  credit: 3 or 4 Hours.
Operations research techniques applied to problems in manufacturing and distribution. Single and multi-stage lot sizing problems, scheduling and sequencing problems, and performance evaluation of manufacturing systems. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: IE 310.

IE 413 Simulation  credit: 3 Hours.
Use of discrete-event simulation in modeling and analysis of complex systems. Data structures and event-list management; verification and validation of simulation models; input modeling, including selection of probability distributions and random variate generation; statistical analysis of output data. Same as CS 482. 3 undergraduate hours. 4 graduate hours. Prerequisite: CS 101 and IE 310.
IE 420  Financial Engineering  credit: 3 or 4 Hours.
Introduction to the theory and practice of financial engineering: basics of derivative securities and risk management; Markowitz portfolio theory and capital asset pricing model; interest rate and bonds; forward and futures contracts, hedging using futures contracts; option contracts and arbitrage relationship; binomial model, no-arbitrage pricing, risk-neutral pricing, and American options pricing; Brownian motion, Black-Scholes-Merton model, delta hedging, Greek letters, implied volatility, and volatility smile. 3 undergraduate hours. 4 graduate hours. Prerequisite: IE 300.

IE 430  Economic Found of Quality Syst  credit: 3 or 4 Hours.
Total quality systems for planning, developing, and manufacturing world-class products. Economic foundations of total quality. Product value, cost, pricing, environmental quality, activity-based costing, design for assembly, organization structure, lead time, innovation, Taguchi methods, simulation-based significance testing, Strategic Quality Deployment, statistical process control, and conjoint analysis. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: IE 300.

IE 431  Design for Six Sigma  credit: 3 Hours.
Quality Engineering principles and the Six Sigma Define-Measure- Analyze-Improve-Control (DMAIC) process. Application of concepts and methods of statistical process control, designed experiments, and measurement systems analysis to cases of quality and productivity improvement; application of the fundamentals of quality engineering and the Six Sigma to areas of produce development, service enterprise, and manufacturing processes. 3 undergraduate hours. 3 graduate hours. Prerequisite: IE 300.

IE 445  Human Performance and Cognition in Context  credit: 3 or 4 Hours.
Same as EPSY 456 and PSYC 456. See EPSY 456.

IE 497  Independent Study  credit: 1 to 4 Hours.
Independent study of advanced problems related to industrial engineering. 1 to 4 undergraduate hours. 1 to 4 graduate hours. May be repeated. Prerequisite: Consent of instructor.

IE 498  Special Topics  credit: 1 to 4 Hours.
Subject offerings of new and developing areas of knowledge in industrial engineering intended to augment the existing curriculum. See Class Schedule or departmental course information for topics and prerequisites. 1 to 4 undergraduate hours. 1 to 4 graduate hours. May be repeated in the same or separate terms if topics vary to a maximum of 9 hours.