# Industrial Engineering (IE)

## Courses

### IE 411. Mechatronics I. 0-4 hours.
Elements of mechatronic systems, sensors, actuators, microcontrollers, modeling, hardware in the loop simulations, real time software, Electromechanical systems laboratory experiments. Course Information: Same as ME 411. 3 undergraduate hours. 4 graduate hours. Extensive computer use required. Prerequisite(s): Senior standing or above or approval of the department. Class Schedule Information: To be properly registered, students must enroll in one Laboratory and one Lecture.

### IE 412. Dynamic Systems Analysis I. 3 or 4 hours.
Classical control theory, concept of feedback, laplace transform, transfer functions, control system characteristics, root locus, frequency response, compensator design. Course Information: Same as ME 412. 3 undergraduate hours. 4 graduate hours. Prerequisite(s): ME 308.

### IE 441. Ergonomics and Human Factors. 3 or 4 hours.
The study of principles and techniques associated with ergonomic problems. Topics include human information input and processing, human output and control, and ergonomic considerations in safety. Course Information: Same as EOHS 441. Previously listed as IE 341. 3 undergraduate hours; 4 graduate hours. Prerequisite(s): Credit or concurrent registration in IE 342 or consent of the instructor.

### IE 442. Design and Analysis of Experiments in Engineering. 0-4 hours.
Covers different methods for statistical design of engineering experiments, executing them and analyzing their results. Course Information: Prerequisite(s): IE 342. Class Schedule Information: To be properly registered, student must enroll in one Lecture-Discussion and one Laboratory-Discussion.

### IE 444. Interdisciplinary Product Development I. 3 or 4 hours.
Systematic approach to the design process. Creative problem solving. Cross-functional teams (w/students from other departments/colleges) research and apply new product concepts to open-ended design problems. Course Information: Same as ME 444. 3 undergraduate hours. 4 graduate hours. Credit for IE 444 is not given if the student has credit in ME 396 or ME 397 or IE 396 or IE 397. Year-long (with IE/ME 445) project course. Prerequisite(s): ME 347 and IE 201; or IE 345 and IE 201; and senior standing or above; and consent of the instructor.

### IE 445. Interdisciplinary Product Development 2. 4 hours.
Cross-functional teams (w/students from AD 420 and MKTG 594) research and develop new product concepts. Focus on solutions to the opportunities identified in IE/ME 444 to functional prototypes. Serves as a replacement for IE/ME 396. Course Information: Same as ME 445. Year-long (with IE/ME 444) project course. Prerequisite(s): IE 444 or ME 444; and senior standing or above; and consent of the instructor. Systematic approach to the design process. Creative problem solving. Cross-functional teams (w/students from other departments/colleges) research and apply new product concepts to open-ended design problems. Focus on solutions to the opportunities. Course Information: Same as ME 445. Credit is not given for IE 445 if the student has credit in ME 396 or ME 397 or IE 396 or IE 397. Year-long (with IE/ME 444) project course. Prerequisite(s): IE 444 or ME 444; and senior standing or above; and consent of the instructor.

### IE 446. Advanced Quality Control and Reliability. 3 or 4 hours.
Principles of statistical quality control including control by variable and by attribute, construction and use of control charts for variables, fraction defectives and number of defects and use of standard plans, reliability and life cycle testing. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): IE 342.

### IE 461. Safety Engineering. 3 or 4 hours.
Human protection systems; accident and emergency handling; manufacturing and service hazard systems. Course Information: Same as EOHS 460. 3 undergraduate hours. 4 graduate hours. Prerequisite(s): IE 342 and IE 365; or consent of the instructor.

### IE 463. Manufacturing Facilities Design and Material Handling. 3 or 4 hours.
Facilities design functions, computer-aided plant layout, facility location, warehouse layout Minimax location, deterministic and probabilistic conveyor models. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): Credit or concurrent registration in IE 201 and Credit or concurrent registration in IE 345 and Credit or concurrent registration in IE 365 and Credit or concurrent registration in IE 472.

### IE 464. Virtual Automation. 0-4 hours.
Fundamentals of manufacturing and automation modeling using CAD/CAM and computer-integrated manufacturing methods; concepts of virtual manufacturing; industrial robots and automated factory models within virtual environments. Course Information: Same as ME 464. 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CS 107 or CS 108. Class Schedule Information: To be properly registered, students must enroll in one Lecture-Discussion, and one Laboratory.

### IE 465. Manufacturing Information Systems. 0-4 hours.
Design and implementation of supervisory control and data acquisition systems; manufacturing systems controller and communication networks. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): Senior or graduate standing, or consent of the instructor; and familiarity with computer programming. Class Schedule Information: To be properly registered, students must enroll in one Laboratory-Discussion and one Lecture-Discussion.

### IE 466. Production Operation Analytics and Inventory Control. 3 or 4 hours.
Principles of production planning, master scheduling, job sequencing, design and control of deterministic and stochastic inventory systems, material requirement planning, and supply chain management. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): IE 345 and Credit or concurrent registration in IE 472.

### IE 467. Discrete Event Computer Simulation Application. 3 or 4 hours.
The solution of industrial application problems by means of discrete event computer simulation. Simulation model building. Input analysis. Output analysis. In depth study of some specific simulation programming languages, with projects. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): IE 342.

### IE 468. Virtual Manufacturing. 3 or 4 hours.
Virtual reality applications in manufacturing systems design, manufacturing applications of networked virtual reality, virtual reality modeling of occupational safety engineering. Course Information: Same as ME 468. 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CS 107 or CS 108.

**IE 471. Operations Research I. 3 or 4 hours.**
Introduction to operations research, formulation of linear programming problems, simplex methods, duality theory, sensitivity analysis, network models, and integer linear programming. Course Information: 3 undergraduate hours. 4 graduate hours. No graduate credit for industrial engineering majors. Prerequisite(s): MATH 310.

**IE 472. Operations Research II. 3 or 4 hours.**
Nonlinear programming problems, unconstrained optimization search techniques. Kuhn-Tucker theorems, quadratic programming, separable programming, meta heuristics, goal programming, and dynamic programming. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CS 107 or CS 109, and IE 471 or graduate standing.

**IE 473. Stochastic Processes and Queuing Models. 3 or 4 hours.**
Stochastic dynamic systems, queuing networks, probabilistic state transition models and nondeterministic decision making models. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): IE 342 and Credit or concurrent registration in IE 471 and MATH 210.

**IE 481. Additive Manufacturing Process. 3 or 4 hours.**
Covers aspects of additive manufacturing. The types that are covered are generic process, design, vat photopolymerization, extrusion based, jetting, direct writing, 3D bio-printing, powder bed fusion, slicing, and data representation. Course Information: Same as ME 481. 3 undergraduate hours. 4 graduate hours. Recommended background: Manufacturing Processes.

**IE 494. Special Topics in Industrial Engineering. 3 or 4 hours.**
Particular topics vary from term to term depending on the interests of the students and the specialties of the instructor. Course Information: 3 undergraduate hours. 4 graduate hours. May be repeated. Prerequisite(s): Consent of the instructor.

**IE 496. Undergraduate Senior Design Thesis I. 0-8 hours.**
Introduction to the principles and practice of product design: specifications, evaluation of design alternatives, technical reports, and oral presentations, through independent design projects. Course Information: Same as ME 496. Credit only given to nondegree students. No graduation credit given to students enrolled in Engineering. Extensive computer use required. Field trips required at a nominal fee. Prerequisite(s): Consent of the instructor.

**IE 497. Undergraduate Senior Design Thesis II. 0-8 hours.**
ntroduction to engineering design and research methods: design tools, product conception and development, simulation, prototyping, technical reports and presentations, literature survey and undergraduate thesis. Course Information: Same as ME 497. Credit only given to nondegree students. No graduation credit given to students enrolled in Engineering. Extensive computer use required. Field trips required at a nominal fee. Prerequisite(s): Consent of the instructor.

**IE 499. Professional Development Seminar. 0 hours.**
Students are provided general information about their role as UIC MIE alumni in society and the role of the University in their future careers. Students provide evaluations of their educational experience in the MIE department. Course Information: Same as ME 499. Satisfactory/ Unsatisfactory grading only. Prerequisite(s): Open only to seniors; and approval of the department. Must be taken in the student's last semester of study.

**IE 511. Mechatronics II. 4 hours.**
Microcontrollers used in electro-mechanical systems for measurement and control purposes, interface hardware, real time software and development tools, applications in robotic motion control and factory automation. Course Information: Same as ME 511. Prerequisite(s): ME 411 and consent of the instructor. Class Schedule Information: To be properly registered, students must enroll in one Laboratory and one Lecture.

**IE 525. Technology to Promote Physical Activitiy Among Persons with Disabilities. 3 hours.**
Applications of new and emerging technologies to promote participation in and adherence to healthful physical activity by people with disabilities. Considers ways of redesigning physical, social and attitudinal environments to achieve these outcomes. Course Information: Same as DHD 525. Recommended background: DHD 515 or an equivalent course on interpreting research findings.

**IE 542. Advanced Computational Methods for Product and Process Design. 4 hours.**
Deterministic and statistical methods for modeling and optimizing engineering systems, in the broad context of product design, manufacturing process development, and designing for life cycle issues. Course Information: Same as ME 542. Prerequisite(s): Programming language experience.

**IE 545. Wearable Robots for Assistance and Rehabilitation. 4 hours.**
Introduces wearable robots to help humans with disabilities and control methods of electromechanical devices that interact with humans such as robotic prostheses and exoskeletons. Model-free intervention methods and human adaptation. Course Information: Same as ME 545. Extensive computer use required. Recommended background: Basic understanding of dynamic systems and control, mechatronics, and programming skills (matlab or python). Class Schedule Information: To be properly registered, students must enroll in one Lecture-Discussion and one Laboratory.

**IE 552. Applied Stochastic Processes. 4 hours.**
Stationary point processes; Markov renewal theory; semi-Markov processes; regenerative processes; computational methods and applications to queues, inventories, dams, and reliability. Course Information: Prerequisite(s): IE 342.

**IE 562. Supervisory Control of Discrete Event Systems. 4 hours.**
Discrete event systems; languages and automata, supervisory control, timed models, supervisory control applications. Course Information: Extensive computer use required.

**IE 565. Expert Systems in Manufacturing. 4 hours.**
Industrial uses of expert systems; applicability to industrial processes; availability of commercial expert systems; design and implementation of expert systems; knowledge engineering, research uses of expert systems. Course Information: Prerequisite(s): CS 102 or CS 107 or the equivalent.

**IE 567. Industrial AI and Applications to Machine Health Diagnosis and Prognosis. 4 hours.**
Industrial AI techniques including deep learning, transfer learning, generative AI, large language model (LLM), IoT-integrated analytics, and related ethics/society/human factors for modern machine health diagnostics and prognosis.

**IE 569. Virtual and Augmented Reality for Industrial Applications. 4 hours.**
Principles and practices of virtual and augmented reality for industrial applications such as manufacturing, construction, transportation, worker training, and human-machine teaming; projects for the design and evaluation of VR/AR applications. Course Information: Same as ME 569. Extensive computer use required.

**IE 571. Statistical Quality Control and Assurance. 4 hours.**
The importance of quality in products and services, quality surveillance, Deming's management method, Ishikawa's seven tools, control charts, acceptance sampling, quality improvement using directed experiments. Course Information: Same as IDS 571. Prerequisite(s): At least one term of statistics.

**IE 575. Integer and Combinatorial Optimization. 4 hours.**
Modeling, computational complexity, polyhedral theory, valid inequalities, duality and relaxation, branch-and-bound algorithms, cutting plane algorithms, heuristic algorithms, and real-world application. Course Information: Prerequisite(s): IE 471.

**IE 576. Nonlinear Optimization. 4 hours.**
Convex analysis, line search techniques, unconstrained and constrained optimization, optimality conditions, duality, convex and nonconvex optimization, large-scale optimization, and real-world applications. Course Information: Prerequisite(s): IE 471 or the equivalent.

**IE 591. Industrial Engineering Internship. 1 hour.**
Provides students with the opportunity to apply the skills and knowledge gained in previous engineering courses within a professional, working environment. Course Information: Satisfactory/Unsatisfactory grading only. May be repeated. A maximum of 4 hours awarded toward degree requirements. Prerequisite(s): Approval of the Department.

**IE 594. Current Topics in Industrial Engineering. 4 hours.**
Particular topics vary from term to term depending on the interests of the students and the specialties of the instructor. Course Information: May be repeated. Prerequisite(s): Consent of the instructor.

**IE 595. Industrial Engineering Seminar. 0-1 hours.**
Advances in Industrial Engineering research will be discussed in a seminar setting. Course Information: Satisfactory/Unsatisfactory grading only. Must be taken every semester by all registered MS and PhD students in Industrial Engineering. Students taking the course for one credit hour submit reflective summaries of the presentations. Prerequisite(s): Graduate standing in industrial engineering.

**IE 596. Independent Study. 1-4 hours.**
Individual study under close supervision of a faculty member. Course Information: May be repeated to a maximum of 4 hours. Students may register in more than one section per term. Prerequisite(s): Consent of the instructor.

**IE 598. M.S. Thesis Research. 0-16 hours.**
Individual research in specialized problems under close faculty supervision. Course Information: Satisfactory/Unsatisfactory grading only. May be repeated. Prerequisite(s): Consent of the instructor.

**IE 599. Ph.D. Thesis Research. 0-16 hours.**
Individual research on specialized problems under close faculty supervision. Course Information: Satisfactory/Unsatisfactory grading only. May be repeated. Prerequisite(s): Consent of the instructor.