INDUSTRIAL ENGINEERING (IER)

IER 220. Production Systems (MER 225). 3 Credits.
This course provides an introduction to production systems, classification, general terminology, technical aspects, economics and analysis of manufacturing systems. Students learn the fundamentals of automation and control technologies as well as manufacturing support systems.
Prerequisites: Sophomore status or permission of the instructor.
Offered: Every year, Fall

IER 230. Lean Systems Engineering (MER 235). 3 Credits.
This course provides a comprehensive and hands-on introduction to Lean Systems and its wide applications, with special emphasis on the Toyota Production System.
Corequisites: Take IER 320 or IER 220 or MER 225.
Offered: Every year, Fall

IER 235. Systems Engineering and Management. 3 Credits.
This course discusses the theory and methods used to design, analyze and manage engineered systems. Students review the principles of system life-cycle management including requirements analysis, system design, functional decomposition, configuration management and systems evaluation. Topics of engineering management emphasizing human relationships, motivational theory and human-systems integration also are addressed.
Prerequisites: None
Offered: Every year, Spring

IER 240. Physical Human Factors and the Workplace (MER 245). 1 Credit.
This course analyzes the impacts of the physical factors of the human decision makers on workflow and efficiency. Basic concepts of anthropometry, biomechanics, work physiology, stress and workload as well as work measurement are introduced. Special emphasis is placed on the capabilities and limitations of humans, in human-centered design of systems and products.
Prerequisites: Sophomore status or permission of the instructor.
Offered: Every year, Fall

IER 250. Computer Aided Design. 3 Credits.
Students explore the use of computer methods as an aid to solving engineering problems. Topics include 3D solid modeling, graphical presentation of information, engineering analysis and engineering computer programming. Students learn to apply a variety of engineering-related programs or routines. Students write, document, and use programs of their own in design scenarios. Considerable emphasis is placed on use of the computer as a tool in the engineering design process.
Prerequisites: Take MA 151 and CSC 106 or CSC 110 and MER 110 or MER 110H or ENR 110 and MER 111.
Offered: Every year, Fall and Spring

IER 265. Cognitive Human Factors and the Workplace (MER 265). 2 Credits.
This course analyzes the impacts of the cognitive factors of the human decision makers on workflow and efficiency. Basic concepts of cognition, as well as sensory systems, such as visual and auditory, are introduced, leading to the analysis of design topics, including displays, controls, shiftwork and work-rest schedules. Special emphasis is placed on the capabilities and limitations of humans, in human-centered design of systems and products.
Prerequisites: Sophomore status or permission of the instructor.
Offered: Every year, Fall

IER 280. Data Analytics I. 3 Credits.
The course presents basic techniques of decision making concentrating on both theoretical and modeling aspects. This course integrates the art and science of decision making for single and multiple objective environments to support the decision-making phase of the Systems Decision Process (SDP). The focus of the course is modeling problem structure, uncertainty, risk and preference in the context of decision making.
Corequisites: Take MA 285.
Offered: Every year, Spring

IER 310. Operations Research I (MER 315). 3 Credits.
This course provides a rigorous introduction to the principles of operations research with a focus on linear programming models and simplex method, duality and sensitivity analysis; transportation and assignment problems; network models; integer and nonlinear programming; an introduction to queuing theory and Markov Chains.
Prerequisites: Take one of the following: Take MA 141 or MA 151
Offered: Every year, Fall

IER 315. Fundamentals of Six Sigma - Black Belt. 3 Credits.
Define-Measure-Analyze-Improve-Control (DMAIC) approach in Six Sigma is an organizational improvement strategy used widely in business applications and Black Belt is the highest belt level among white, yellow, green, and black belts. Students are introduced to the DMAIC steps for improvement of a process and using data-driven measuring, analysis, improvement and controlling techniques to solve the defined problem at Black Belt level. Topics include quality improvement philosophies, modeling process quality, statistical process control, lean techniques, human factors, analysis of data sets, data analytics applications on collected data by using sampling strategies, design of control charts, use of statistical distributions for data analysis and process capability. This course is not for Industrial Engineering majors.
Prerequisites: Take MA 170 EC 272 PS 206 MA 206 MA 285 or another statistics course approved by the instructor. Minimum Grade C-;
Offered: As needed

IER 360. Operations Planning and Control. 3 Credits.
This course focuses on analytical techniques for work scheduling and materials planning in the manufacturing, service and health care industries. The main objective is to develop the ability to use engineering tools for industrial engineering practice in operations and materials management. Topics include forecasting, production and material planning, inventory analysis and scheduling techniques.
Prerequisites: Take MA 285.
Offered: As needed

IER 365. Scheduling in Manufacturing and Health Care with Machine Learning Applications. 3 Credits.
This course introduces students to several scheduling techniques and improvement methodologies utilized in manufacturing and health care. Improvement of manufacturing scheduling by using deterministic optimization modeling for single and parallel machine workflow as well as various shop models such as job shops, flow shops, and open shops are covered. The health care scheduling coverage of the course is based on accessibility to health care systems, scheduling of operations, and wait times of patients. Optimization of health care operations by using mathematical formulation is emphasized. Additionally, machine learning concepts such as supervised learning, unsupervised learning, decision trees, and random forest concepts are covered with applications in manufacturing and health care.
Prerequisites: Take MA 151.
Offered: As needed

IER 370. Industrial Robotics (MER 375). 3 Credits.
Students are introduced to robotics and their use in industrial applications. The topics covered in this course include robotics basic programming, types of robots, drive systems for robots, sensors' use in robotics, robot and computer interaction, improvement and analysis of systems' design using robotics, analysis of systems' design using robotics, and robotics applications in manufacturing, health care and service areas.
Prerequisites: Take CSC 110, CSC 110L, CSC 106 or CSC 109.
Offered: As needed

IER 375. Statistical Process Control. 3 Credits.
The main focus in this course is to understand and implement the Define-Measure-Analyze-Improve-Control (DMAIC) approach in Six Sigma. Therefore, defining a problem for improvement of a process and using data-driven measuring, analysis, improvement and controlling techniques to solve the defined problem are the essentials of this course. Topics include quality improvement philosophies, modeling process quality, statistical process control, control charts for variables and attributes, single- and multivariable regression analysis of data sets, sampling strategies, economic design of charts, use of statistical distributions for data analysis and process capability.
Prerequisites: Take MA 285.
Offered: Every year, Fall

IER 380. Data Analytics II. 2 Credits.
This course focuses on analytical skill development for extracting meaningful information from data sets by using technology. Analytical skills includes linear and non-linear regressions, ANOVA, hypothesis testing, and predictive data analysis. The technological skillset development includes reading, analyzing and interpreting data sets by learning how to use a software package.
Prerequisites: Take IER 280.
Corequisites: Take IER 381.
Offered: As needed

IER 381. Data Analytics and Advanced Programming. 1 Credit.
This course focuses on analytical skill development for extracting meaningful information from data sets by using technology. Analytical skills includes linear and non-linear regressions, ANOVA, hypothesis testing, and predictive data analysis. The technological skillset development includes reading, analyzing and interpreting data sets by learning how to use a software package.
Prerequisites: Take CSC 110, CSC 110L; or CSC 106.
Corequisites: Take IER 380.
Offered: As needed

IER 400. Special Topics in Industrial Engineering. 1-4 Credits.
Prerequisites: None
Offered: As needed

IER 401. Introduction to Engineering Management. 3 Credits.
This course concentrates on the general methodology of managing an engineering project from concept to operational use, with emphasis on the functions, roles, and responsibilities of the engineering manager. Topics include career aspects of engineering management; business factors affecting the engineering projects and the manager; technical engineering project organization, planning, execution, and communications; project life cycle; basic risk analysis; design review; design control assessment; reporting; and reaction to critical problems. Student groups will be working on an engineering project scenario that simulates the development of a computing or engineering project with time, cost, and quality decisions to be made as the engineering project manager during the execution of the project.
Prerequisites: Take MA 170 or MA 285 and Junior Status in Major
Offered: Every year, Fall

IER 402. Engineering Quality Management & Decision Making. 3 Credits.
In this course, students will gain knowledge in the application of quality improvement methodology for project management purposes. Emphasis will be placed on philosophical approaches to quality improvement and quantitative methods taking place in engineering projects. The following topics will be included: Corporate Quality Programs, Applications for Quality Improvement, Measurement Systems Analysis, Experimental Design, Root Cause Analysis, and Design for Quality. The participants will also be introduced to decision-making tools needed to analyze data sets.
Prerequisites: Take IER 401.
Offered: Every year, Spring

IER 410. Designing and Managing the Supply Chain. 3 Credits.
This course provides an introduction to the techniques of supply chain management, focusing on logistics, purchasing and product development processes. The main objective is develop competence in quantitative methods for analyzing and solving supply chain problems in a variety of industries that include manufacturing, services and health care. Topics include supply chain performance, network design, product availability and sustainable supply chain management.
Prerequisites: Take IER 360.
Offered: As needed

IER 420. Industrial Control Systems (MER 425). 3 Credits.
Students explore classical control systems through modern control methods based on state variable models, feedback models, controllers and full-state observers. Students gain experience in computer-aided design and analysis using Matlab.
Prerequisites: Take IER 220 or MER 225.
Offered: As needed

IER 425. Quality Engineering and Inspection Systems. 3 Credits.
The focus of this course is to select and implement quality control solutions for industrial processes. Practical quality control systems are examined for applicability and relevance. Topics include the costs of quality, automated and manual measurement, quality control integration, sampling requirements, ANSI and ISO blueprint reading and geometric dimensioning along with the tolerance calculations. The course demonstrates various systems used in quality control plans and key factors required in developing a quality conscious atmosphere.
Prerequisites: Take IER 230.
Offered: As needed

IER 440. Simulation. 3 Credits.
This course includes a simulation of complex systems with applications in industrial engineering. Topics include modeling and developing custom solutions in one or more high-level computer packages; input distribution modeling; emphasizing examples, applications and cases.
Prerequisites: Take MA 285.
Offered: Every year, Spring

IER 450. Health Care Systems Engineering. 3 Credits.
This course introduces students to health care organizations, including hospitals, clinics, multihospital systems and other facilities as an integrated delivery system. By emphasizing practical application of diverse operations involved in such a system, various quantitative modeling and optimization techniques are discussed and applied to solve problems.
Prerequisites: Take IER 230
Offered: Every year, Spring

IER 460. Facilities Layout and Material Handling. 3 Credits.
The focus of this course is the design of industrial facilities with consideration of work organization and layout. Students study product and process designs as a part of facilities planning, material handling systems, flow systems, departmental planning and layout algorithms, space requirements for facilities, and receiving and shipping principles. The course also covers the engineering techniques used for determining the best location of a brand new facility.
Prerequisites: Take IER 320 or IER 220.
Offered: Every year, Fall

IER 470. Industrial Robotics and Advanced Programming. 3 Credits.
Students continue to develop and advance their robotics knowledge introduced in IER 370 - Industrial Robotics - by adding more to their basic robotics programming knowledge. Participants of this course continue to learn about advanced robotics applications in manufacturing, health care, service and systems design.
Prerequisites: Take IER 370.
Offered: As needed

IER 475. Human Reliability. 1 Credit.
This course focuses on the principles, methods and tools for the analysis, design and evaluation of human decision making within human-centered systems. The impacts of human perceptual and cognitive factors are analyzed, leading to design principles for error-prevention. This course is complementary to IER 265, Cognitive Human Factors and the Workplace. Sophomore status required.
Prerequisites: None
Offered: Every year, Fall

IER 485. System Reliability. 2 Credits.
This course provides an introduction to failure rates, failure risk analysis and system configurations, such as series, parallel and redundant systems. It also discusses design for reliability and optimal maintenance and replacement policies.
Prerequisites: Take MA 285, MA 142 or MA 152.
Offered: Every year, Fall

IER 489. Advanced Independent Study in IE. 1-6 Credits.
This is a tutorial course or an individual project in which the student pursues advanced study in systems engineering or engineering management. The scope of the course is tailored to the desires of the student in consultation with a faculty adviser. Communication skills are developed with both written reports and oral presentations. Requires approval of faculty member.
Prerequisites: None
Offered: Every year, Fall and Spring

IER 490. Engineering Professional Experience. 0-1 Credits.
Students gain at least 240 hours of experience by employing industrial engineering skills in a professional setting. Students must obtain departmental approval and register prior to starting the experience. Prerequisite may be waived with permission of adviser.
Prerequisites: Take ENR 395.
Offered: Every year, All

IER 491. Capstone Project I. 3 Credits.
This is the first part of a two-semester capstone design experience for senior industrial engineering students. Students apply knowledge gained throughout the curriculum to a significant project. Furthermore, this course aims to strengthen the students' oral and written communication skills as well as teamwork and conflict resolution. Students work in teams to formulate issues and collect data at an external organization before beginning to perform analysis and propose solutions in the subsequent course--IER 498.
Corequisites: Take IER 330 or IER 230; IER 430 or IER 375.
Offered: Every year, Fall

IER 492. Six Sigma - Black Belt Project Exp I. 3 Credits.
This is the first part of a two-semester Six Sigma - Black Belt project experience for students. Students are introduced to the Define-Measure-Analyze-Improve-Control (DMAIC) steps for improvement of a process and using data-driven measuring, analysis,improvement and controlling techniques to solve the defined problem at Black Belt level of Six Sigma. Topics include quality improvement philosophies,modeling process quality, statistical process control, lean techniques,human factors, analysis of data sets, data analytics applications on collected data by using sampling strategies, design of control charts, use of statistical distributions for data analysis and process capability. Furthermore, this course aims to strengthen the students' oral and written communication skills as well as team work and conflict resolution. Students work in teams to formulate issues and collect data at an external organization before beginning to perform analysis and propose solutions in the subsequent course IER 497.This course is not for Industrial Engineering majors.
Prerequisites: Take MA 170, EC 272, PS 206, MA 206, MA 285 or another statistics course approved by the instructor. Minimum grade C-.
Offered: As needed

IER 497. Six Sigma - Black Belt Project Experience II. 3 Credits.
This is the second part of a two-semester capstone design experience for industrial engineering students. The purpose of a capstone project is to give senior students the opportunity to apply knowledge gained throughout the curriculum to a significant project. After formulating the problem and commencing data collection in IER 492, the student teams continue their project in IER 497 by completing data collection, performing analysis and modeling, and finally recommending solutions to help address the client issue(s).
Prerequisites: Take IER 492;
Offered: As needed

IER 498. Capstone Project II. 3 Credits.
This is the second part of a two-semester capstone design experience for industrial engineering students. The purpose of a capstone project is to give senior students the opportunity to apply knowledge gained throughout the curriculum to a significant project. After formulating the problem and commencing data collection in IER 491, the student teams continue their project in IER 498 by completing data collection, performing analysis and modeling, and finally recommending solutions to help address the client issue(s).
Prerequisites: Take IER 491.
Corequisites: Take IER 280 IER 310 IER 360;
Offered: Every year, Spring