INDUSTRIAL AND SYSTEMS ENGINEERING (I SY E)

I SY E 1 – COOPERATIVE EDUCATION PROGRAM
1 credit.

Work experience which combines classroom theory with practical knowledge of operations to provide students with a background upon which to base a professional career in industry.
Requisites: Sophomore standing
Course Designation: Workplace - Workplace Experience Course
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

I SY E 191 – THE PRACTICE OF INDUSTRIAL ENGINEERING
2 credits.

An introduction to industrial engineering subject matter areas, problem types, and design/analysis approaches, techniques, and methodologies. Special emphasis on formulation and design alternatives for problem solving.
Requisites: None
Repeatable for Credit: No
Last Taught: Spring 2024

I SY E 210 – INTRODUCTION TO INDUSTRIAL STATISTICS
3 credits.

Introduction to basic probability and statistical tools and methods from an industrial application perspective. Random variables and probability distributions; descriptive statistics; point estimates. Perform hypothesis testing, construct confidence intervals, and understand design of experiments in the context of motivating case studies. Regression and correlation analysis. Focus on applying statistical methods and tools to solve engineering problems. Use of Microsoft Excel to interpret and analyze data.
Requisites: (MATH 211, 217, 221, or 275) or member of Engineering Guest Students
Repeatable for Credit: No
Last Taught: Spring 2024

I SY E 312 – DATA MANAGEMENT AND ANALYSIS FOR INDUSTRIAL ENGINEERS
3 credits.

Fundamentals of data management and analysis. Formulating and solving real industrial engineering problems with appropriate data managing and modeling strategies. Fundamental industrial database management strategies, data preprocessing, visualization and modeling techniques; industrial database management and analysis techniques using leading programming software (MySQL and R).
Requisites: (I SY E 210, E C E 331, MATH/STAT 309, STAT 311, or 324) or member of Engineering Guest Students
Repeatable for Credit: No
Last Taught: Spring 2024

I SY E 313 – ENGINEERING ECONOMIC ANALYSIS
3 credits.

Financial accounting principles and cost systems, interpretation and use of accounting reports and supplemental information for engineering economic analyses, consideration of cost-volume-profit analyses, use of discounted cash flow techniques, flexible budgeting, transfer pricing, and capital budgeting.
Requisites: (MATH 217, 221, or 275 or concurrent registration), graduate/professional standing, or member of Engineering guest Students
Repeatable for Credit: No
Last Taught: Spring 2024

I SY E 315 – PRODUCTION PLANNING AND CONTROL
3 credits.

Techniques and applications of control concepts in the design of inventory, production, quality, and project-planning systems; use of the computer as a component in such systems.
Requisites: (I SY E 210, E C E 331, MATH/STAT 309, STAT 311, 324, 371, MATH/STAT 431, 531, or concurrent enrollment), graduate/professional standing, or member of Engineering Guest Students
Repeatable for Credit: No
Last Taught: Spring 2024

I SY E 320 – SIMULATION AND PROBABILISTIC MODELING
3 credits.

Analysis of stochastic systems using both analytic methods and computer simulation. Empirical and theoretical models of arrival and service processes. State spaces and state transition probabilities. Simulation of queuing and manufacturing systems. Continuous time Markov analysis of manufacturing systems. Simulation project management, testing and emerging trends.
Requisites: (MATH/STAT 309, STAT 311, MATH/STAT 431, 531 or concurrent enrollment) and (I SY E 210, E C E 331, STAT/MATH 310, STAT 312, 324, 371, or concurrent enrollment) and (MATH 320, 340, or concurrent enrollment), or member of Engineering Guest Students
Repeatable for Credit: No
Last Taught: Spring 2024

I SY E 321 – SIMULATION MODELING LABORATORY
1 credit.

Computer exercises involving generation and analysis of random variables, spreadsheet models of queuing systems, use of simulation software packages. Project.
Requisites: Concurrent enrollment in I SY E 320
Repeatable for Credit: No
Last Taught: Spring 2024

I SY E 323 – OPERATIONS RESEARCH-DETERMINISTIC MODELING
3 credits.

Basic techniques for modeling and optimizing deterministic systems with emphasis on linear programming. Computer solution of optimization problems. Applications to production, logistics, and service systems.
Requisites: (MATH 222 or 276) and (MATH 340, 341 or 375), or member of Engineering Guest Students
Repeatable for Credit: No
Last Taught: Spring 2024

I SY E 348 – INTRODUCTION TO HUMAN FACTORS ENGINEERING LABORATORY
1 credit.

Hands on experience applying concepts discussed in I SY E/PSYCH 349. Complete a small three-part design project. Learn how to measure light, sound, anthropometric, and psychophysiological data, and then apply these measurements to product and workplace design challenges.
Requisites: Declared in Industrial Engineering and concurrent enrollment in I SY E/PSYCH 349, or member of Engineering Guest Students
Repeatable for Credit: No
Last Taught: Spring 2024

I SY E/PSYCH 349 – INTRODUCTION TO HUMAN FACTORS
3 credits.

Conveys the importance of considering human capabilities and limits in system design and operation. This includes understanding human characteristics from the cognitive, physical, and psychosocial perspectives. Implications of these characteristics are explored through understanding the needs of people, designing to support these needs, and evaluating systems to ensure they serve the intended purpose. Case studies are used to identify the human role in accidents and to identify design improvements. Application domains include consumer product design, human-computer interaction, workplace safety, and complex systems such as healthcare delivery.
Requisites: (I SY E 210, E C E 331, MATH/STAT 309, 431, STAT 311, 324, 371, MATH 531, PSYCH 210, or C&E SOC/SOC 360, or concurrent registration), graduate/professional standing, or member of Engineering Guest Students
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2024

I SY E 350 – INDUSTRIAL ENGINEERING DESIGN I
3 credits.

Introduction to the tools needed for advanced design courses through experiential learning and hands-on opportunities to conduct experiments, take relevant measurements, analyze real-world data, design systems, and to make and test prototypes of designs.
Requisites: Declared in Industrial Engineering, (COMP SCI 200, 220, 300, 301, 302, or placement into COMP SCI 300), (I SY E 210, MATH/STAT 309, 431, MATH 531, STAT 311 or 324) and I SY E 315
Repeatable for Credit: No
Last Taught: Spring 2024

I SY E 389 – HONORS IN RESEARCH
1-3 credits.

Undergraduate honors research projects supervised by faculty members.
Requisites: Declared in Industrial Engineering Honors in Research
Course Designation: Honors - Honors Only Courses (H)
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2013

I SY E 412 – FUNDAMENTALS OF INDUSTRIAL DATA ANALYTICS
3 credits.

Provides an understanding of the fundamentals of using data analytics to make data-driven decisions. Emphasizes applying techniques to industrial engineering problems. Focuses on formulating and solving real industrial problems with the appropriate modeling strategies and analytics principles for better decision making.
Requisites: (I SY E 210, E C E 331, STAT 311, 324, MATH/STAT 309, 431, or MATH 531), graduate/professional standing, or member of Engineering Guest Students
Repeatable for Credit: No
Last Taught: Spring 2024

I SY E 415 – INTRODUCTION TO MANUFACTURING SYSTEMS, DESIGN AND ANALYSIS
3 credits.

Introduction to the technologies, processes and systems of modern discrete part manufacturing. Emphasis on development of an understanding of the behavior of integrated systems.
Requisites: I SY E 315 or member of Engineering Guest Students
Repeatable for Credit: No
Last Taught: Spring 2024

I SY E 417 – HEALTH SYSTEMS ENGINEERING
3 credits.

Introduction to the application of industrial engineering methods to the analysis and improvement of health care delivery. Exploration of common problems of decision making and control in health care. Examination of social, regulatory and economic factors unique to health care.
Requisites: I SY E 320 and 349, graduate/professional standing, or member of Engineering Guest Students, or declared in Clinical and Community Outcomes Capstone Certificate
Repeatable for Credit: No
Last Taught: Spring 2024

I SY E/COMP SCI/MATH 425 – INTRODUCTION TO COMBINATORIAL OPTIMIZATION
3 credits.

Focuses on optimization problems over discrete structures, such as shortest paths, spanning trees, flows, matchings, and the traveling salesman problem. We will investigate structural properties of these problems, and we will study both exact methods for their solution, and approximation algorithms.
Requisites: (MATH 320, 340, 341, or 375) or graduate/professional standing or member of the Pre-Masters Mathematics (Visiting International) Program
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Fall 2023

I SY E 450 – INDUSTRIAL ENGINEERING DESIGN II
3 credits.

Team-based project experience to address a real-world design challenge posed by an external organization. Collaboration with the project client to design a new system or process, or redesign an existing one, by integrating and applying appropriate Industrial and Systems Engineering knowledge, methodologies and tools for problem definition and analysis; idea generation; solution development, evaluation and justification; and implementation planning and impact assessment.
Requisites: Senior standing only, I SY E 313, 320, 323, 350, and PSYCH/ I SY E 349
Repeatable for Credit: No
Last Taught: Spring 2024

I SY E 468 – INTRODUCTION TO INDUSTRIAL ENGINEERING RESEARCH
1 credit.

An introduction to the practice of conducting research in industrial engineering, literature reviews, identifying gaps in existing work, writing a research proposal.
Requisites: Consent of instructor
Course Designation: Honors - Honors Only Courses (H)
Repeatable for Credit: No
Last Taught: Spring 2023

I SY E 476 – INDUSTRIAL ENGINEERING PROJECTS
3 credits.

Complete design of an industrial engineering system in a real world setting, e.g., manufacturing, hospital, communications, food processing, distribution, transportation, etc.
Requisites: I SY E 320, 349, and INTEREGR 397 (formerly E P D 397)
Repeatable for Credit: No
Last Taught: Spring 2015

I SY E 478 – RESEARCH AND BEYOND IN INDUSTRIAL ENGINEERING
1 credit.

An introduction of skills required for successful research in graduate school. Preparing for graduate thesis writing, applying for graduate school, presenting research in a variety of ways. How to foster mental health and work-life balance.
Requisites: I SY E 468
Course Designation: Honors - Honors Only Courses (H)
Repeatable for Credit: No
Last Taught: Fall 2023

I SY E 489 – HONORS IN RESEARCH
1-3 credits.

Undergraduate honors research projects supervised by faculty members.
Requisites: Declared in Industrial Engineering Honors in Research
Course Designation: Honors - Honors Only Courses (H)
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Fall 2023

I SY E/M E 510 – FACILITIES PLANNING
3 credits.

Introduction to plant location theory and analysis of models of plant location; models for determining plant size and time phasing; line balancing models; techniques for investigating conveyor and other material handling problems; and models of plant layout.
Requisites: I SY E 315, (I SY E 323 or E C E/COMP SCI/I SY E 524) and I SY E/PSYCH 349, or graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

I SY E/M E 512 – INSPECTION, QUALITY CONTROL AND RELIABILITY
3 credits.

Inspection data for quality control; sampling plans for acceptance inspection; charts for process control. Introduction to reliability models and acceptance testing.
Requisites: (STAT/MATH 309, STAT 311, 224, 324, or STAT/MATH 431), graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

I SY E 515 – ENGINEERING MANAGEMENT OF CONTINUOUS PROCESS IMPROVEMENT
3 credits.

Addresses the role of the industrial engineer as a "manager" of continuous improvement in design and production processes. Provides modern tools and techniques for planning and managing team projects, integrating the concepts of total quality, data based decision making, and resource management.
Requisites: Senior standing and INTEREGR 397 (formerly E P D 397) or concurrent enrollment, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2022

I SY E 516 – INTRODUCTION TO DECISION ANALYSIS
3 credits.

Overview of modeling techniques and methods used in decision analysis, including multiattribute utility models, decision trees, and Bayesian models. Psychological components of decision making are discussed. Elicitation techniques for model building are emphasized. Practical applications through real world model building are described and conducted.
Requisites: (STAT/MATH 309, STAT 311, or STAT/MATH 431), graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2022

I SY E 517 – DECISION MAKING IN HEALTH CARE
3 credits.

Introduction to the use of decision sciences in health-care. Conceptual understanding of medical decision making and its tools including decision trees, sensitivity analysis, Markow (decision) processes, and Monte Carlo simulations with examples from the current medical literature.
Requisites: (STAT/MATH 309, STAT 311, or STAT/MATH 431) and (I SY E 323 or E C E/COMP SCI/I SY E 524), or graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

I SY E/COMP SCI/DS 518 – WEARABLE TECHNOLOGY
3 credits.

Gives students hands-on experience in building wearable computing platforms. Designed for students who have a background in textiles and apparel design, computer science, engineering or media arts. By the completion of the course students will have fundamental knowledge of electronic circuitry, programming, and "maker skills".
Requisites: Sophomore standing
Course Designation: Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2022

I SY E 520 – QUALITY ASSURANCE SYSTEMS
3 credits.

Introduces engineers to applications of total quality concepts and tools to develop, implement, and maintain an effective quality assurance system in a manufacturing or service organization. Emphasis is on documentation development, team-based improvement strategies, and international quality standards.
Requisites: Junior standing and I SY E 315, or graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

I SY E 521 – MACHINE LEARNING IN ACTION FOR INDUSTRIAL ENGINEERS
3 credits.

Principles, algorithms, and industrial engineering applications of machine learning. Predictive analytics, with a focus on combining data and models to improve decision-making. Methods include: statistics, linear regression, logistic regression, regularization, over-fitting, clustering, classification and regression trees, boosting, bagging, deep learning, and neural networks. Applications areas include: healthcare, transportation, and the public sector.
Requisites: (COMP SCI 200, 220, or placement into COMP SCI 300), (I SY E 323 or I SY E/COMP SCI/E C E 524), and (I SY E 210, STAT 311, 324, STAT/MATH 309, or 431), graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

I SY E/COMP SCI/E C E 524 – INTRODUCTION TO OPTIMIZATION
3 credits.

Introduction to mathematical optimization from a modeling and solution perspective. Formulation of applications as discrete and continuous optimization problems and equilibrium models. Survey and appropriate usage of basic algorithms, data and software tools, including modeling languages and subroutine libraries.
Requisites: (COMP SCI 200, 220, 300, 301, 302, 310, or placement into COMP SCI 300) and (MATH 320, 340, 341, or 375) or graduate/professional standing
Course Designation: Breadth - Natural Science
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2024

I SY E/COMP SCI/MATH/STAT 525 – LINEAR OPTIMIZATION
3 credits.

Introduces optimization problems whose constraints are expressed by linear inequalities. Develops geometric and algebraic insights into the structure of the problem, with an emphasis on formal proofs. Presents the theory behind the simplex method, the main algorithm used to solve linear optimization problems. Explores duality theory and theorems of the alternatives.
Requisites: MATH 320, 340, 341, 375, or 443 or graduate/professional standing or member of the Pre-Masters Mathematics (Visiting International) Program
Course Designation: Breadth - Natural Science
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

I SY E/COMP SCI 526 – ADVANCED LINEAR PROGRAMMING
3 credits.

Review of linear programming. Polynomial time methods for linear programming. Quadratic programs and linear complementarity problems and related solution techniques. Solution sets and their continuity properties. Error bounds for linear inequalities and programs. Parallel algorithms for linear and quadratic programs.
Requisites: STAT/COMP SCI/I SY E/MATH 525 and (COMP SCI 200, 220, 300, 301, 302, 310, or placement into COMP SCI 300) or graduate/professional standing
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2020

I SY E/PSYCH 549 – HUMAN FACTORS ENGINEERING
3 credits.

Analysis and design of man-machine systems using human performance models and data. Emphasis on systems involving communication and control. Projects using digital and analog computer simulation techniques for system design.
Requisites: I SY E/PSYCH 349, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

I SY E 552 – HUMAN FACTORS ENGINEERING DESIGN AND EVALUATION
3 credits.

Evaluation, analysis, and design recommendations for improving human performance and productivity in applied settings. Collection of instrument-based and user survey data. Emphasis on ergonomics, human factors and sociotechnical systems engineering approaches and problems. Design project required.
Requisites: I SY E/PSYCH 349 and INTEREGR 397 (formerly E P D 397) or concurrent enrollment or graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2020

I SY E 555 – HUMAN PERFORMANCE AND ACCIDENT CAUSATION
3 credits.

A systems view of accident causation, with emphasis on the human performance limitations important in industrial and other accidents. Models of causation, data collection systems, economic evaluation, and safety programs. Small group projects.
Requisites: I SY E/PSYCH 349, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

I SY E 557 – HUMAN FACTORS ENGINEERING FOR HEALTHCARE SYSTEMS
3 credits.

Introduction to the application of Human Factors Engineering theory and methods to the analysis and improvement of healthcare delivery systems.
Requisites: PSYCH/I SY E 349, or graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

I SY E/COMP SCI/M E 558 – INTRODUCTION TO COMPUTATIONAL GEOMETRY
3 credits.

Introduction to fundamental geometric computations and algorithms, and their use for solving engineering and scientific problems. Computer representations of simple geometric objects and paradigms for algorithm design. Applications from areas of engineering analysis, design and manufacturing, biology, statistics, and other sciences.
Requisites: (COMP SCI 367 or 400) and MATH 234 or graduate/professional standing
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2018

I SY E/MED PHYS 559 – PATIENT SAFETY AND ERROR REDUCTION IN HEALTHCARE
2 credits.

Techniques for evaluating and reducing risks in medical procedures, including probabilistic risk assessment methods, failure mode and effects analysis, human factors analysis, and quality management. Discussions of patient safety standards, recommendations from agencies, and continual quality improvement.
Requisites: Consent of instructor
Course Designation: Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2019

I SY E 562 – HUMAN FACTORS OF DATA SCIENCE AND MACHINE LEARNING
3 credits.

An examination of the "human side" of data science. Issues of bias, fairness, trust, and understandability. Unique characteristics of behavioral data, such as representative sampling, human adaptation, and grouped data. Practical skills in behavioral data analytics with a focus on important conceptual, design, and ethical issues specific to behavioral data. Survey of machine learning techniques including supervised learning, unsupervised learning, reinforcement learning, deep learning, and text analysis. Methods are contextualized through engineering case studies.
Requisites: (I SY E 210, E C E 331, MATH/STAT 310, STAT 312, or 340), graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

I SY E/B M E 564 – OCCUPATIONAL ERGONOMICS AND BIOMECHANICS
3 credits.

Introduces engineers how to design manufacturing and industrial operations in which people play a significant role, so that human capabilities are maximized, physical stress is minimized, and workload is optimized. Examples and topics emphasize industrial applications.
Requisites: PSYCH/I SY E 349 or B M E 315, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

I SY E/E C E 570 – ETHICS OF DATA FOR ENGINEERS
3 credits.

Introduction to ethical issues in data engineering and principled solutions. Algorithmic fairness (individual fairness, group fairness, counterfactual fairness), differential privacy and its applications, and robustness.
Requisites: I SY E 521, 562, M E/COMP SCI/E C E 532, 539, or graduate/professional standing
Repeatable for Credit: No
Last Taught: Spring 2024

I SY E/N E 574 – METHODS FOR PROBABILISTIC RISK ANALYSIS OF NUCLEAR POWER PLANTS
3 credits.

Methods for risk and reliability analysis of engineered systems, particularly as applied in the nuclear power industry. Fault trees and event trees, Bayesian data analysis, probabilistic risk management. Some familiarity with nuclear plant safety systems is helpful, but not required.
Requisites: (STAT/MATH 309, STAT 311, 224, 324, or STAT/MATH 431), graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2023

I SY E 575 – INTRODUCTION TO QUALITY ENGINEERING
3 credits.

Introduction to statistically based quality improvement methods useful in industrial settings; observational methods and design of experiments; experimentation to discover influential factors and to analyze sources of variation; robust products.
Requisites: (I SY E 210, MATH/STAT 310, STAT 312 or concurrent enrollment), graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Summer 2023

I SY E 601 – SPECIAL TOPICS IN INDUSTRIAL ENGINEERING
1-3 credits.

In various areas. Sample topics: "Simulation" and "Systems Design".
Requisites: None
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Fall 2020

I SY E 602 – SPECIAL TOPICS IN HUMAN FACTORS
3 credits.

Various special topics in human factors engineering. Course topic may vary from semester to semester. Different versions of this course may be offered in same semester.
Requisites: None
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Fall 2022

I SY E 603 – SPECIAL TOPICS IN ENGINEERING ANALYTICS AND OPERATIONS RESEARCH
1-3 credits.

Various special topics in engineering analytics and operations research, such as machine learning, data management and analysis, optimization, etc.
Requisites: None
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

I SY E 604 – SPECIAL TOPICS IN MANUFACTURING AND SUPPLY CHAIN MANAGEMENT
1-3 credits.

Various special topics in manufacturing systems and supply chain management, such as digital manufacturing technologies, Internet of Things (IoT), supply chain, etc.
Requisites: None
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

I SY E 605 – COMPUTER INTEGRATED MANUFACTURING
3 credits.

An introduction to computer-integrated design and manufacturing with a focus on manufacturing process planning. Emphasis on concurrent engineering principles, manufacturing process engineering, computer-aided process planning, NC programming, and CAM integration. Course provides experience with CAM software and NC machines.
Requisites: I SY E 315, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

I SY E 606 – SPECIAL TOPICS IN HEALTHCARE SYSTEMS ENGINEERING
1-3 credits.

Various special topics in healthcare systems engineering, such as human factors in healthcare settings, operations research applied to healthcare, etc.
Requisites: None
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions

I SY E/PHARMACY 608 – SAFETY AND QUALITY IN THE MEDICATION USE SYSTEM
3 credits.

Addresses the problems of medication errors and quality in health care, problem resolutions, methods of assessment, and intervention implementation and quality management.
Requisites: Declared in Doctor of Pharmacy program with third year standing
Repeatable for Credit: No
Last Taught: Fall 2023

I SY E 612 – INFORMATION SENSING AND ANALYSIS FOR MANUFACTURING PROCESSES
3 credits.

Focuses on the sensing and multivariate data modeling and analysis techniques for monitoring, diagnosis, and quality improvement of manufacturing processes. The techniques introduced can find wide applications in health care, financial engineering, service industry applications, human factors, etc.
Requisites: I SY E/M E 512, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

I SY E 615 – PRODUCTION SYSTEMS CONTROL
3 credits.

An intermediate to advanced course stressing the application of recent operations research techniques to production planning, scheduling and inventory control.
Requisites: I SY E 315, 320, and 323 and (STAT/MATH 310, STAT 312 or STAT/MATH 431), graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

I SY E/B M I 617 – HEALTH INFORMATION SYSTEMS
3 credits.

Provides grounding in core concepts of health information systems. Major applications include clinical information systems, language and standards, decision support, image technology and digital libraries. Evaluation of IE tools and perspectives designed to improve the quality, efficiency and effectiveness of health information.
Requisites: I SY E 417, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2016

I SY E 618 – QUALITY ENGINEERING AND QUALITY MANAGEMENT
3 credits.

Strategic quality planning, change management, problem identification and solving, process improvement, and performance evaluation. Business and decision-making skills related to quality systems and process improvement.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

I SY E 620 – SIMULATION MODELING AND ANALYSIS
3 credits.

Introduction to simulation modeling and analysis techniques with application to production, logistics, service, and other systems. Emphasis on model building, application of basic statistical data analysis, and the use of simulation for design, evaluation, and improvement of such systems. Introduction to available software. Case studies.
Requisites: (COMP SCI 200, 220, 300, 301, 302, or placement into COMP SCI 300) and (STAT 224, 312, 324, or STAT/MATH 310), graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2023

I SY E 624 – STOCHASTIC MODELING TECHNIQUES
3 credits.

Techniques for modeling systems in which uncertainty is an essential factor. Emphasizes why, how and when techniques can or cannot be applied, rather than their mathematical derivation. Case studies and/or examples from such areas as logistics, production, and service industries.
Requisites: (STAT/MATH 309, 311, or STAT/MATH 431) and (MATH 320, 340, 341, or 375), graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

I SY E 625 – LOGISTICS SYSTEMS DESIGN
3 credits.

Practical methods for the planning, design and evaluation of complex logistics and distribution systems. Modeling techniques and solution approaches that reduce cumbersome details of logistics systems into models with a manageable number of parameters and decision variables. It shows how the solutions to these models are interpreted into optimal rules that guide the operation, design or planning process. Practical methods for the planning, design and evaluation of complex logistics and distribution systems. Modeling techniques and solution approaches that reduce cumbersome details of logistics systems into models with a manageable number of parameters and decision variables. It shows how the solutions to these models are interpreted into optimal rules that guide the operation, design or planning process. Builds on knowledge of introductory programming such as Python, Matlab, or R.
Requisites: (I SY E 323 or E C E/COMP SCI/I SY E 524) and (I SY E 210, E C E 331, MATH/STAT 310, STAT 312, 324, or 340), graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No

I SY E/MATH/OTM/STAT 632 – INTRODUCTION TO STOCHASTIC PROCESSES
3 credits.

Topics include discrete-time Markov chains, Poisson point processes, continuous-time Markov chains, and renewal processes. Applications to queueing, branching, and other models in science, engineering and business.
Requisites: (STAT/MATH 431, 309, STAT 311 or MATH 531) and (MATH 320, 340, 341, 375, 421 or 531) or graduate/professional standing or member of the Pre-Masters Mathematics (Visiting International) Program
Course Designation: Breadth - Natural Science
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

I SY E/COMP SCI 635 – TOOLS AND ENVIRONMENTS FOR OPTIMIZATION
3 credits.

Formulation and modeling of applications from computer sciences, operations research, business, science and engineering involving optimization and equilibrium models. Survey and appropriate usage of software tools for solving such problems, including modeling language use, automatic differentiation, subroutine libraries and web-based optimization tools and environments.
Requisites: (MATH 320, 340, 341, or 375) and (COMP SCI 200, 300, 301, 302, placement into COMP SCI 300, or L I S/COMP SCI 102 (COMP SCI 202 prior to Fall 2023)); grad/professional standing; declared in the Capstone Certificate in Computer Sciences for Professionals
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2015

I SY E/M E 641 – DESIGN AND ANALYSIS OF MANUFACTURING SYSTEMS
3 credits.

Covers a broad range of techniques and tools relevant to the design, analysis, development, implementation, operation and control of modern manufacturing systems. Case studies assignments using industry data will be used to elaborate the practical applications of the theoretical concepts.
Requisites: I SY E 315, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

I SY E/M E 643 – PERFORMANCE ANALYSIS OF MANUFACTURING SYSTEMS
3 credits.

Examines the state of the art in the use of stochastic network theory to develop performance models of modern manufacturing systems.
Requisites: (I SY E 624 or STAT/I SY E/MATH/OTM 632) and (COMP SCI 200, 220, 300, 301, 302, 400, or placement into COMP SCI 300), graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2021

I SY E 645 – ENGINEERING MODELS FOR SUPPLY CHAINS
3 credits.

Provides an overview of engineering fundamentals behind supply chains. Topics covered will include modeling and design of multi-stage production distribution systems, multi-echelon inventory models, theory of supply chain contracts, value of flexibility and information sharing in supply chains.
Requisites: I SY E 323 and I SY E 415, or graduate/professional standing, or member of Engineering Guest Students
Repeatable for Credit: No
Last Taught: Fall 2023

I SY E 649 – INTERACTIVE DATA ANALYTICS
3 credits.

A cognitive engineering approach to human-computer interaction and data visualization in particular. Includes a four-part description of effective visualization: design intent, data and application domain, representation and interface features, and human limits and capabilities. The philosophical perspective, scientific basis, and practical tools for effective data visualization and visual analytics. Data processing and how to create static graphs as well as web-based interactive visualizations using the statistical language R.
Requisites: I SY E/PSYCH 349 and (I SY E 210, E C E 331, MATH/STAT 310, STAT 312, 324, or 340), graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

I SY E/PSYCH 653 – ORGANIZATION AND JOB DESIGN
3 credits.

Design of productive organizations and people's roles within them. Issues including boundary location, organizational decision levels, autonomous work groups, implementation and diffusion. Roles of the union. Case studies.
Requisites: I SY E/PSYCH 349, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2021

I SY E/B M E 662 – DESIGN AND HUMAN DISABILITY AND AGING
3 credits.

Design of products for persons with physical, sensory or cognitive impairments is covered as well as the design of standard mass market products. Interdisciplinary teams explore specific disabilities, then design a standard mass market product in competition with each other.
Requisites: Junior standing or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

I SY E 699 – ADVANCED INDEPENDENT STUDY
1-5 credits.

Under faculty supervision.
Requisites: Consent of instructor
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

I SY E 702 – GRADUATE COOPERATIVE EDUCATION PROGRAM
1-2 credits.

Work experience that combines classroom theory with practical knowledge of operations to provide students with a background on which to develop and enhance a professional career. The work experience is tailored for MS students from within the U.S. as well as eligible international students.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

I SY E/POP HLTH 703 – QUALITY OF HEALTH CARE: EVALUATION AND ASSURANCE
1-3 credits.

Implementation, oversight, and management of quality-oriented activities in health care settings. Overview of current and historical activities, approaches, and issues confronting health care related to quality assessment, assurance, and improvement.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2018

I SY E/C&E SOC/N E/SOC 708 – SOCIETAL RISK MANAGEMENT OF TECHNOLOGICAL HAZARDS
3 credits.

Issues involved in decision-making regarding technological risks and risk management in areas such as nuclear power, hazardous waste disposal, and pollution control. Risk perception and cognitive biases; risk analysis and decision analysis; political issues in risk management; regulatory mechanisms; and risk communication. Selected case studies.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2020

I SY E/COMP SCI 719 — STOCHASTIC PROGRAMMING
3 credits.

Stochastic programming is concerned with decision making in the presence of uncertainty, where the eventual outcome depends on a future random event. Topics include modeling uncertainty in optimization problems, risk measures, stochastic programming algorithms, approximation and sampling methods, and applications. Students are strongly encouraged to have knowledge of linear programming (e.g., MATH/COMP SCI/I SY E/STAT 525) and probability and statistics (e.g., MATH/STAT 431). Knowledge of integer optimization (MATH/COMP SCI/I SY E 728) is helpful, but not required.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

I SY E/INFO SYS 722 — COMPUTER-BASED DATA MANAGEMENT
3 credits.

Use, control and administration of centralized and distributed data bases. Topics include the definition, design, creation, revision, interrogation, update, security and integrity of data bases.
Requisites: Graduate/professional standing and INFO SYS 371
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2020

I SY E/COMP SCI 723 — DYNAMIC PROGRAMMING AND ASSOCIATED TOPICS
3 credits.

General and special techniques of dynamic programming developed by means of examples. Shortest-path algorithms. Deterministic equipment replacement models. Resource allocation problem. Traveling-salesman problem. Knapsack problem. Analysis of inventory systems. General stochastic formulations. Markovian decision processes. Students are strongly encouraged to have knowledge of mathematical optimization (e.g., COMP SCI/I SY E/MATH/STAT 525, I SY E 623, COMP SCI/I SY E/MATH/STAT 726), knowledge of analysis (e.g., MATH/STAT 431 or 521) and programming ability (e.g., COMP SCI 200 or 301)
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

I SY E/COMP SCI/MATH/STAT 726 — NONLINEAR OPTIMIZATION I
3 credits.

Theory and algorithms for nonlinear optimization, focusing on unconstrained optimization. Line-search and trust-region methods; quasi-Newton methods; conjugate-gradient and limited-memory methods for large-scale problems; derivative-free optimization; algorithms for least-squares problems and nonlinear equations; gradient projection algorithms for bound-constrained problems; and simple penalty methods for nonlinearly constrained optimization. Students are strongly encouraged to have knowledge of linear algebra and familiarity with basic mathematical analysis.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

I SY E/COMP SCI 727 — CONVEX ANALYSIS
3 credits.

Convex sets in finite-dimensional spaces: relative interiors, separation, set operations. Convex functions: conjugacy, subdifferentials and directional derivations, functional operations, Fenchel-Rockafellar duality. Applications to operations research and related areas. Students taking this course are strongly encouraged to have had a course in basic analysis (e.g. MATH 521) and a course in linear algebra (e.g., MATH 340).
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2020

I SY E/COMP SCI/MATH 728 — INTEGER OPTIMIZATION
3 credits.

Introduces optimization problems over integers, and surveys the theory behind the algorithms used in state-of-the-art methods for solving such problems. Special attention is given to the polyhedral formulations of these problems, and to their algebraic and geometric properties. Applicability of Integer Optimization is highlighted with applications in combinatorial optimization. Key topics include: formulations, relaxations, polyhedral theory, cutting planes, decomposition, enumeration. Students are strongly encouraged to have knowledge of Linear Programming (e.g., MATH/COMP SCI/I SY E/STAT 525), including algorithms, duality and polyhedral theory.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

I SY E/M H R 729 – BEHAVIORAL ANALYSIS OF MANAGEMENT DECISION MAKING
3 credits.

Examination of behavioral science literature dealing with the processes by which individuals, small groups and organizations make decisions. Understanding decision-making behavior in order to improve managerial performance; modeling decision-making processes for systems design and theory building purposes. Knowledge of statistics strongly encouraged such as STAT 301.
Requisites: Graduate/professional standing or declared in graduate Business Exchange program
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2022

I SY E/COMP SCI/MATH 730 – NONLINEAR OPTIMIZATION II
3 credits.

Theory and algorithms for nonlinearly constrained optimization. Relevant geometric concepts, including tangent and normal cones, theorems of the alternative, and separation results. Constraint qualifications. Geometric and algebraic expression of first-order optimality conditions. Second-order optimality conditions. Duality. Nonlinear programming algorithms: merit functions and filters; interior-point, augmented Lagrangian, and sequential quadratic programming algorithms.
Requisites: STAT/COMP SCI/I SY E/MATH 726
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2022

I SY E 790 – MASTER'S RESEARCH AND THESIS
1-9 credits.

Directed Master's-level research projects as arranged with instructor.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

I SY E 823 – SPECIAL TOPICS IN OPERATIONS RESEARCH
1-3 credits.

Subjects vary.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2021

I SY E/PSYCH 854 – SPECIAL TOPICS IN ORGANIZATION DESIGN
1-3 credits.

Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Fall 2020

I SY E/PSYCH 859 – SPECIAL TOPICS IN HUMAN FACTORS ENGINEERING
1-3 credits.

Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Fall 2023

I SY E/POP HLTH 875 – COST EFFECTIVENESS ANALYSIS IN HEALTH AND HEALTHCARE
3 credits.

Basic ideas and tools of cost effectiveness analysis as applied in evaluating medical technologies. Addresses special problems and methods in assessing diagnostic technologies, including ROC analysis, and in measuring health for technology assessment. Uses "classical" and current journal literature.
Requisites: SOC/POP HLTH 797 and POP HLTH/B M I 552
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

I SY E 890 – PRE-DISSERTATOR'S RESEARCH
1-9 credits.

Directed PhD-level research projects as arranged with faculty advisor.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

I SY E 961 – GRADUATE SEMINAR IN INDUSTRIAL ENGINEERING
1-3 credits.

Topics vary.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

I SY E 990 – RESEARCH AND THESIS
1-6 credits.

Directed PhD-level research projects as arranged with faculty advisor.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

I SY E 999 – ADVANCED INDEPENDENT STUDY
1-6 credits.

Under faculty supervision.
Requisites: Consent of instructor
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Fall 2022