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 2026
Learning Outcomes: 1. Identify and respond appropriately to real-life engineering ethics cases relevant to co-op work
Audience: Undergraduate

2. Synthesize and apply appropriate technical education to real world technical work
Audience: Undergraduate

3. Communicate effectively in writing and speaking with a range of audiences in the workplace, including those without disciplinary expertise
Audience: Undergraduate

4. Develop professional and transferable habits like time management skills, collaborative problem-solving skills, and research skills for learning new information
Audience: Undergraduate

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 2026
Learning Outcomes: 1. Define and explain common industrial engineering terminology
Audience: Undergraduate

2. Give examples of career opportunities in industrial engineering
Audience: Undergraduate

3. List the focus areas in industrial engineering and give a brief explanation of how each area uses industrial engineering principles
Audience: Undergraduate

4. Give examples of problems in each area of industrial engineering
Audience: Undergraduate

5. Identify professional and academic development resources available to industrial engineering students
Audience: Undergraduate

6. Investigate an open-ended industrial engineering problem and think critically about how to solve it
Audience: Undergraduate

7. Analyze small datasets using Microsoft Excel
Audience: Undergraduate

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, or 221) or member of Engineering Guest Students
Repeatable for Credit: No
Last Taught: Spring 2026
Learning Outcomes: 1. Articulate the importance of statistics in engineering applications
Audience: Undergraduate

2. Summarize and describe data using descriptive statistics and graphical methods
Audience: Undergraduate

3. Perform basic statistical analysis on datasets
Audience: Undergraduate

4. Design simple experiments with data for the purpose of statistical analysis
Audience: Undergraduate

5. Use Excel to describe, analyze, graph, and interpret data
Audience: Undergraduate

6. Apply linear and multiple regression techniques
Audience: Undergraduate

7. Apply experiment and analysis techniques to areas of engineering such as Statistical Process Control
Audience: Undergraduate

8. Apply basic probability concepts such as random variables, independence, and probability distributions
Audience: Undergraduate

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 2026
Learning Outcomes: 1. Demonstrate knowledge of fundamental industrial database management strategies
Audience: Undergraduate

2. Apply data preprocessing, visualization, and modeling techniques
Audience: Undergraduate

3. Apply industrial database management techniques using structured query language (SQL)
Audience: Undergraduate

4. Use leading programming software to perform data regression analysis
Audience: Undergraduate

5. Create and solve a real-life industrial data analytics problem, and present results effectively to audience
Audience: Undergraduate

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 concurrent enrollment), graduate/professional standing, or member of Engineering Guest Students
Repeatable for Credit: No
Last Taught: Spring 2026
Learning Outcomes: 1. Apply discounted cash-flow analysis to evaluate proposed capital investments
Audience: Undergraduate

2. Recognize, formulate, and analyze cash-flow models
Audience: Undergraduate

3. Explain model results to managers and other non-specialist decision makers
Audience: Undergraduate

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 2026
Learning Outcomes: 1. Describe and apply fundamental principles and methodologies relevant to planning, design, operation, and control of production planning and control systems
Audience: Undergraduate

2. Describe and explain how organizational strategy drives operations management approaches and supply chain decisions
Audience: Undergraduate

3. Develop a portfolio of analytical tools and skills related to production planning and control and operations management
Audience: Undergraduate

4. Recognize situations in production system environments that suggest the use of appropriate quantitative methods to assist in decision-making
Audience: Undergraduate

5. Apply skills and tools to reduce waste and to increase productivity and quality in manufacturing and service organizations
Audience: Undergraduate

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 2026
Learning Outcomes: 1. Apply knowledge of math, science, and engineering principles to model real stochastic systems
Audience: Undergraduate

2. Identify, formulate, and solve problems using appropriate data analytic and simulation approaches
Audience: Undergraduate

3. Understand and apply probabilistic modeling techniques such as Markov Chains and queueing theory to study stochastic systems
Audience: Undergraduate

4. Apply statistical methods to analyze stochastic behaviors of the systems
Audience: Undergraduate

5. Apply simulation software to model the process and evaluate performance measures of the systems
Audience: Undergraduate

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 2026
Learning Outcomes: 1. Apply knowledge of math, science, and engineering principles to model real stochastic systems
Audience: Undergraduate

2. Identify, formulate, and solve problems using appropriate data analytic and simulation approaches
Audience: Undergraduate

3. Understand and apply probabilistic modeling techniques such as Markov Chains and queueing theory to study stochastic systems
Audience: Undergraduate

4. Apply statistical methods to analyze stochastic behaviors of the systems
Audience: Undergraduate

5. Apply simulation software to model the process and evaluate performance measures of the systems
Audience: Undergraduate

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 and (MATH 340, 341 or 375), or member of Engineering Guest Students
Repeatable for Credit: No
Last Taught: Spring 2026
Learning Outcomes: 1. Write an algebraic formulation of an optimization model that captures the main decision elements of practical problems
Audience: Undergraduate

2. Use an algebraic modeling language to solve an optimization model
Audience: Undergraduate

3. Model logical constraints using binary decision variables
Audience: Undergraduate

4. Understand the basic ideas behind algorithms for solving linear programming and discrete optimization problems
Audience: Undergraduate

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 2026
Learning Outcomes: 1. Recognize the strengths and limits of human perceptual, cognitive and physical abilities and their implications for system design
Audience: Undergraduate

2. Describe human factors tools, techniques and methods commonly used to design and improve system performance
Audience: Undergraduate

3. Evaluate and recommend work and task designs based on human factors and ergonomic principle
Audience: Undergraduate

4. Define the ethical application of human factors in designing products and processes
Audience: Undergraduate

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 2026
Learning Outcomes: 1. Recognize the strengths and limits of human perceptual, cognitive and physical abilities and their implications for system design
Audience: Undergraduate

2. Describe human factors tools, techniques and methods commonly used to design and improve system performance
Audience: Undergraduate

3. Evaluate and recommend work and task designs based on human factors and ergonomic principles
Audience: Undergraduate

4. Define the ethical application of human factors in designing products and processes
Audience: Undergraduate

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 2026
Learning Outcomes: 1. Apply basic industrial engineering design methods
Audience: Undergraduate

2. Use appropriate industrial and systems engineering design tools forestablishing solutions to open-ended problems
Audience: Undergraduate

3. Select the appropriate methods to utilize in order to collect real-world data
Audience: Undergraduate

4. Observe and collect data relevant to an industrial engineering problem
Audience: Undergraduate

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
Learning Outcomes: 1. Conduct and report on independent industrial engineering research
Audience: Undergraduate

2. Independently develop industrial engineering research questions
Audience: Undergraduate

3. Appropriately utilize online and library resources
Audience: Undergraduate

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 2026
Learning Outcomes: 1. Apply fundamental knowledge of industrial data analytics concepts, problems, and techniques
Audience: Undergraduate

2. Integrate data analytics techniques with industrial and systems engineering domain knowledge to appropriately formulate problem statements and facilitate decision making
Audience: Undergraduate

3. Implement software programming skills to perform data analysis
Audience: Undergraduate

4. Apply industrial data analytics methods and tools to solve real-world industrial engineering problems
Audience: Undergraduate

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, member of Engineering Guest Students, or graduate/professional standing
Repeatable for Credit: No
Last Taught: Fall 2025
Learning Outcomes: 1. Distinguish advantages and disadvantages for a range of manufacturing processes
Audience: Undergraduate

2. Select an appropriate manufacturing process when given information such as part design, material, and production quantity
Audience: Undergraduate

3. Use terminology that relates to manufacturing systems design and analysis
Audience: Undergraduate

4. Examine manufacturing system performance by applying analytical techniques such as line balancing, manufacturing system benchmarking, inventory models, and queuing formulas
Audience: Undergraduate

5. Utilize computer-aided design and manufacturing software to display part geometry and create toolpaths for a CNC program
Audience: Undergraduate

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 2026
Learning Outcomes: 1. Describe and explain the purpose of the various components that make-up many health systems including public health agencies (e.g., CDC), hospital systems, emergency medical services (e.g., 9-1-1), healthcare providers, and health insurance
Audience: Undergraduate

2. Identify problems within health systems that may be amenable to industrial engineering tools
Audience: Undergraduate

3. Apply industrial systems engineering concepts and tools (e.g., regression, queueing theory, simulation, cost-benefit analysis, and machine learning) to specific problems in healthcare
Audience: Undergraduate

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 2025
Learning Outcomes: 1. Identify and use the structural properties of combinatorial optimization problems
Audience: Undergraduate

2. Apply algorithms for the solution -exact or approximate- of a combinatorial optimization problem
Audience: Undergraduate

3. Explain why the algorithms studied are correct and understand their running time
Audience: Undergraduate

I SY E 445 – ENGINEERING SUPPLY CHAIN MANAGEMENT FOR LOGISTICS
3 credits.

Concepts from optimization, stochastics, and statistics to model different problems in the context of logistics decision making. Application of engineering design principles in combination with mathematical modeling techniques to solve problems in supply chain design, planning, execution, and transportation.
Requisites: (I SY E 210, MATH/STAT 310, STAT 312, 324, or 340) and (I SY E 323 or I SY E/COMP SCI/E C E 524), graduate/professional standing, or member of Engineering Guest Students
Repeatable for Credit: No
Last Taught: Spring 2026
Learning Outcomes: 1. Explain common supply chain management terminology and concepts used in industry settings
Audience: Undergraduate

2. Evaluate supply chain strategies and policies based on the two key drivers of supply chains: cost efficiency and responsiveness
Audience: Undergraduate

3. Apply mathematical modeling of inventory management, transportation, and network design problems to real world settings
Audience: Undergraduate

4. Design holistic supply chain strategies drawing from multiple mathematical models to successfully meet business goals
Audience: Undergraduate

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 2026
Learning Outcomes: 1. Employ design thinking, and engage the client in the creative process for problem space exploration and idea generation
Audience: Undergraduate

2. Utilize a structured modeling, analysis and decision#making framework to design a new system or process, or re#design an existing one
Audience: Undergraduate

3. Choose, synthesize and effectively utilize appropriate ISyE methods, concepts, engineering standards, and modeling and analysis tools in all facets of the project lifecycle
Audience: Undergraduate

4. Adjust and be flexible with design strategy and adapt it suitably to address unanticipated issues during project execution
Audience: Undergraduate

5. Hone skills in teamwork, oral and written communication, and project management
Audience: Undergraduate

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 2026
Learning Outcomes: 1. Conduct a literature review
Audience: Undergraduate

2. Identify gaps in existing research
Audience: Undergraduate

3. Describe characteristics of a good research question
Audience: Undergraduate

4. Write a proposal to address an open research question
Audience: Undergraduate

5. Describe some current active research areas in industrial engineering
Audience: Undergraduate

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 2025
Learning Outcomes: 1. Prepare materials for graduate program applications, such as a personal statement
Audience: Undergraduate

2. List key elements of research ethics and common pitfalls in different types of research
Audience: Undergraduate

3. Make a poster summarizing completed and/or in-progress work
Audience: Undergraduate

4. Give a technical presentation summarizing completed and/or in-progress work
Audience: Undergraduate

5. Critique technical research presentations
Audience: Undergraduate

6. List strategies for maintaining healthy work-life balance in graduate school
Audience: Undergraduate

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 2025
Learning Outcomes: 1. Conduct and report on independent industrial engineering research
Audience: Undergraduate

2. Independently develop industrial engineering research questions
Audience: Undergraduate

3. Appropriately utilize online and library resources
Audience: Undergraduate

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 2025
Learning Outcomes: 1. Identify, formulate, and solve facilities layout problems by applying principles of engineering and mathematics
Audience: Both Grad & Undergrad

2. Apply engineering design to produce facilities design solutions that meet specified needs with consideration of productivity, safety, and economic factors
Audience: Both Grad & Undergrad

3. Utilize computer software to study and illustrate the operation of a manufacturing system
Audience: Both Grad & Undergrad

4. Collaborate with a team to develop solutions to engineering problems and communicate findings effectively
Audience: Both Grad & Undergrad

5. Demonstrate ability to lead a facilities planning project integrating quantitative techniques and management tools
Audience: Graduate

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 2026
Learning Outcomes: 1. Apply statistical process control analysis for measuring and controlling quality
Audience: Undergraduate

2. Recognize, formulate, and analyze univariate continuous and discrete control charts
Audience: Undergraduate

3. Use Minitab to perform basic statistical process control analysis
Audience: Undergraduate

4. Communicate the results of the statistical process control analysis to management and other non-specialist users of engineering analyses
Audience: Undergraduate

5. Recognize, formulate, and analyze advanced continuous control charts
Audience: Graduate

6. Perform process capability and measurement system capability analysis

Audience: Graduate

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 2025
Learning Outcomes: 1. Describe and explain the nature of and tools for change management and continual process improvement
Audience: Both Grad & Undergrad

2. Experience the role of the industrial and systems engineer as a “manager" of continual process improvement
Audience: Both Grad & Undergrad

3. Work effectively on a team-based experiential project focused on process design, analysis, and resource management and integrating the concepts of continual improvement, customer focus, and teamwork
Audience: Both Grad & Undergrad

4. Implement technical skills and processes, often with a non-technical workforce
Audience: Both Grad & Undergrad

5. Apply problem solving and management/planning tools for effectively defining problems, feasible alternative solutions, and measurable goals in a “real world” environment
Audience: Both Grad & Undergrad

6. Identify the impact of organizational and cultural influences on the planning and implementation of change
Audience: Both Grad & Undergrad

7. Demonstrate ability to lead an industry-based team project integrating contemporary change management frameworks and considering organizational culture
Audience: Graduate

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, member of Engineering Guest Students, or declared in Capstone Certificate in Artificial Intelligence for Engineering Data Analytics
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2025
Learning Outcomes: 1. Recognize the types of problems that decision analysis can and cannot solve
Audience: Both Grad & Undergrad

2. Structure decision problems by identifying the relevant values, objectives, attributes, decisions, uncertainties, consequences, and trade-offs
Audience: Both Grad & Undergrad

3. Represent aspects of a decision problem graphically or mathematically
Audience: Both Grad & Undergrad

4. Determine the optimal decision, using mathematical techniques as appropriate
Audience: Both Grad & Undergrad

5. Identify which parameters have the most impact on the result
Audience: Both Grad & Undergrad

6. Explain the results of a decision analysis to managers and other non-specialists
Audience: Both Grad & Undergrad

7. Articulate mathematical foundations of decision problems
Audience: Graduate

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 2025
Learning Outcomes: 1. Explain how decision sciences are used in the health-care industry
Audience: Both Grad & Undergrad

2. Describe concepts related to medical decision making and cost-effectiveness analysis
Audience: Both Grad & Undergrad

3. Apply technical skills in decision analysis including the creation and evaluation of decision trees, the use of sensitivity analysis, and the use of Markov processes and Monte Carlo simulation
Audience: Both Grad & Undergrad

4. Incorporate specific patient preferences into medical decision models through the use of utility analysis
Audience: Both Grad & Undergrad

5. Identify and apply an advanced decision analytical modeling framework to solve medical decision making problems
Audience: Graduate

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 2025
Learning Outcomes: 1. Describe and apply the basic elements of quality and environmental management systems, including the requirements and certification process of international standards such as ISO 9001 and ISO 14001 and industry-specific applications of these standards
Audience: Both Grad & Undergrad

2. Apply concepts and tools in the development, implementation, and maintenance of effective quality and environmental management systems in manufacturing and service organizations, including various approaches for management system documentation structure
Audience: Both Grad & Undergrad

3. Describe and explain strategic and competitive considerations in management system implementation and maintenance, including risk-based thinking and continual improvement
Audience: Both Grad & Undergrad

4. Develop and apply auditing techniques and skills
Audience: Both Grad & Undergrad

5. Demonstrate ability to synthesize and apply requirements for quality and environmental management considering organizational strategy, culture and constraints
Audience: Graduate

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 place 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), grad/prof standing, member of Engr Guest Stdnts, or declared in Capstone Cert in AI for Engr Data Analytics
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2026
Learning Outcomes: 1. Identify problems amenable to machine learning and the techniques required to solve those problems (regression vs. classification, regularization, bagging vs. boosting, etc.)
Audience: Both Grad & Undergrad

2. Apply appropriate analytical models to solve problems and improve decision-making using Python
Audience: Both Grad & Undergrad

3. Effectively communicate findings through both oral and written formats

Audience: Both Grad & Undergrad

4. Demonstrate an understanding of how industrial engineering techniques (e.g., optimization) are used to train machine learning models
Audience: Graduate

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 2026
Learning Outcomes: 1. Engage in topics about "optimization in practice".
Audience: Undergraduate

2. Use and analyze the results of state of the art optimization software.
Audience: Undergraduate

3. Use the GAMS modeling system and Jupyter notebooks (in conjunction with elementary Python) or Julia and JUMP.
Audience: Undergraduate

4. Design good models for realistic applications in engineering and the sciences.
Audience: Undergraduate

5. Develop a "commercial strength" application of optimization technology.
Audience: Undergraduate

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 2026
Learning Outcomes: 1. Use linear programming to formulate real world decision problems.
Audience: Both Grad & Undergrad

2. Apply algorithms to solve linear programming problems and demonstrate their correctness.
Audience: Both Grad & Undergrad

3. Combine different proving techniques explored in class in an original way to show new results.
Audience: Graduate

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
Learning Outcomes: 1. Use the theory of linear programming to prove general duality results
Audience: Undergraduate

2. Apply the concept of complementarity
Audience: Undergraduate

3. Analyze and develop algorithms for solving optimization and equilibrium problems
Audience: Undergraduate

4. Apply decomposition methods and other advanced algorithms for the solution of optimization and equilibrium problems
Audience: Undergraduate

5. Understand economic concepts and how they relate to optimization and equilibria
Audience: Undergraduate

6. Extend theory of linear programming into the framework of conic programming
Audience: Undergraduate

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: Spring 2026
Learning Outcomes: 1. Explain the topics involved in cognitive human factors and design implications of these concepts
Audience: Both Grad & Undergrad

2. Describe the interactions between human operators and system components including the environment, technology, and organizations
Audience: Both Grad & Undergrad

3. Discuss different human factors perspectives regarding human error and limitations of human performance, especially as these relate to memory, decision-making, action selection, and workload and stress
Audience: Both Grad & Undergrad

4. Identify barriers and limitations to memory and how these must be accounted for in design of systems and displays
Audience: Both Grad & Undergrad

5. Articulate the role of simulation and modeling in system design involving human operators
Audience: Both Grad & Undergrad

6. Use cognitive engineering analysis methods to complete a detailed analysis of a real incident or accident including outlining each layer and component of system failure and proposing possible redesign solutions
Audience: Graduate

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 2026
Learning Outcomes: 1. Apply observation and interview skills to understand customer needs and system interactions
Audience: Both Grad & Undergrad

2. Translate observation and interview data into models of customer requirements and system constraints
Audience: Both Grad & Undergrad

3. Communicate model content to the customer and to marketing, engineering, management, and other members of the design team
Audience: Both Grad & Undergrad

4. Translate work models into aesthetically appealing and functional design concepts and prototypes
Audience: Both Grad & Undergrad

5. Evaluate and iterate prototype designs into a system that satisfies customer requirements
Audience: Both Grad & Undergrad

6. Design a user study to resolve a design issue, such as the choice of opt-in or opt-out default
Audience: Graduate

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 2025
Learning Outcomes: 1. Explain the rules and regulations governing accident investigations in different industries including transportation and healthcare
Audience: Both Grad & Undergrad

2. Describe the standard process for conducting an accident investigation
Audience: Both Grad & Undergrad

3. Describe basic accident investigation tools, methods and techniques
Audience: Both Grad & Undergrad

4. Discuss different human factors perspectives regarding the underlying causes of errors and accidents
Audience: Both Grad & Undergrad

5. Identify different approaches for redesigning systems to improve safety

Audience: Both Grad & Undergrad

6. Utilize accident investigation methods and tools to analyze a major accident to determine causes and corrective actions
Audience: Graduate

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: Spring 2026
Learning Outcomes: 1. Explain Human Factors Engineering theories and methods as they pertain to the evaluation and design of healthcare sociotechnical systems
Audience: Both Grad & Undergrad

2. Select and critically evaluate the utility of key Human Factors Engineering concepts and tools for assessing and modeling healthcare delivery challenges in sociotechnical systems
Audience: Both Grad & Undergrad

3. Identify the impact of changes to the healthcare sociotechnical system at the individual and organizational level
Audience: Both Grad & Undergrad

4. Apply a Human Factors Engineering-based sociotechnical system approach to evaluate and design interaction between users and information technologies
Audience: Both Grad & Undergrad

5. Demonstrate the use of Human Factors Engineering techniques in solving healthcare delivery problems within the organizational, social, and physical contexts in information system design
Audience: Both Grad & Undergrad

6. Demonstrate ability to independently evaluate Human Factors Engineering research in healthcare
Audience: Graduate

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 2026
Learning Outcomes: 1. Consider human values and behavior in developing and using machine learning models
Audience: Both Grad & Undergrad

2. Apply a human-centered design process to data and algorithm-intensive products
Audience: Both Grad & Undergrad

3. Describe the basic elements of machine learning and their limits
Audience: Both Grad & Undergrad

4. Analyze a case study of machine learning deployed by a company and discuss strengths and limits of the deployment using the concepts of the course.
Audience: Graduate

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 2026
Learning Outcomes: 1. Evaluate jobs, equipment, tools, products, and environments, in which people play a significant role, for health and safety hazards and the risk of injuries and illnesses
Audience: Both Grad & Undergrad

2. Devise how to reduce or eliminate physical stresses and the risk of injuries and illnesses in jobs, equipment, tools, products, and environments

Audience: Both Grad & Undergrad

3. Design jobs, workspaces and products for a diverse work population, to accommodate the variability of human dimensions strength, endurance, and physical capacity to do work
Audience: Both Grad & Undergrad

4. Design jobs equipment, tools, products, and environments so that human capabilities are maximized, physical stress is minimized, and workload is optimized
Audience: Both Grad & Undergrad

5. Identify fundamental physiological principles and biomechanical theories that are germane to the evaluation, design and reduction or elimination of stresses and strain in jobs, equipment, tools, products, and environments
Audience: Graduate

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, or 539) and (E C E 331, MATH/STAT 309, STAT 311, MATH 331, or STAT/MATH 431), or graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2025
Learning Outcomes: 1. Describe the importance of ethical data science/engineering
Audience: Both Grad & Undergrad

2. Identify challenges of trustworthy data use in engineering such as fairness, privacy, and robustness
Audience: Both Grad & Undergrad

3. Apply the definitions of trustworthy data engineering to real-world datasets
Audience: Both Grad & Undergrad

4. Analyze the data analysis pipelines and evaluate the trustworthiness of their outcomes
Audience: Both Grad & Undergrad

5. Create proper data analysis pipelines with ethical considerations
Audience: Both Grad & Undergrad

6. Implement cutting-edge techniques to enhance the fairness, privacy, and robustness of data analysis processes
Audience: Graduate

7. Conduct independent research on emerging challenges in ethical data engineering
Audience: Graduate

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 2025
Learning Outcomes: 1. Correctly apply methods of fault tree, event-tree, data, and uncertainty analysis to evaluate potential risks of engineering systems
Audience: Both Grad & Undergrad

2. Recognize, formulate, and analyze risks of engineered systems
Audience: Both Grad & Undergrad

3. Explain the results of risk analysis to managers and other non-specialist decision-makers
Audience: Graduate

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 2025
Learning Outcomes: 1. Design experiments for various phases of engineering work, including new product design and development, process development, manufacturing process improvement, and health systems design and improvement
Audience: Both Grad & Undergrad

2. Analyze the results of experiments conducted at different phases of engineering work
Audience: Both Grad & Undergrad

3. Apply data analysis skills in statistical methodologies, graphical displays, and visual and inferential interpretations
Audience: Both Grad & Undergrad

4. Work effectively in an experiential project focused on applying appropriate statistical tools and techniques
Audience: Both Grad & Undergrad

5. Explain the eight phases of Six Sigma and apply these steps to a wide range of actual situations
Audience: Both Grad & Undergrad

6. Demonstrate ability to synthesize applications of statistical methodologies via analysis of current literature and case studies
Audience: Graduate

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: Spring 2026
Learning Outcomes: 1. Identify and describe key theories, concepts, and methods in human factors engineering
Audience: Both Grad & Undergrad

2. Apply key theories, concepts, and methods in human factors engineering, using appropriate tools, processes, and/or software
Audience: Both Grad & Undergrad

3. Apply, analyze, or evaluate advanced theories, concepts, or methods in human factors engineering
Audience: Graduate

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 2026
Learning Outcomes: 1. Identify and describe key theories, concepts, and methods in engineering analytics and operations research
Audience: Both Grad & Undergrad

2. Apply key theories, concepts, and methods in engineering analytics and operations research, using appropriate tools, processes, and/or software
Audience: Both Grad & Undergrad

3. Apply, analyze, or evaluate advanced theories, concepts, or methods in engineering analytics and operations research
Audience: Graduate

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: Fall 2025
Learning Outcomes: 1. Identify and describe key theories, concepts, and methods in manufacturing and supply chain management
Audience: Both Grad & Undergrad

2. Apply key theories, concepts, and methods in manufacturing and supply chain management, using appropriate tools, processes, and/or software
Audience: Both Grad & Undergrad

3. Apply, analyze, or evaluate advanced theories, concepts, or methods in manufacturing and supply chain management
Audience: Graduate

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
Learning Outcomes: 1. Identify and formulate manufacturing process and system level problems by applying principles of engineering and mathematics
Audience: Both Grad & Undergrad

2. Design the geometry of a mechanical component and develop computer code needed to fabricate the component
Audience: Both Grad & Undergrad

3. Apply principles of engineering and mathematics to solve process- and system-level problems such as setting process parameters and evaluating the system performance
Audience: Both Grad & Undergrad

4. Demonstrate ability to combine different modeling and analysis methods explored in the class for manufacturing processes and systems to achieve strategies for performance improvement
Audience: Graduate

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
Learning Outcomes: 1. Identify and describe key theories, concepts, and methods in healthcare systems engineering
Audience: Both Grad & Undergrad

2. Apply key theories, concepts, and methods in healthcare systems engineering, using appropriate tools, processes, and/or software
Audience: Both Grad & Undergrad

3. Apply, analyze, or evaluate advanced theories, concepts, or methods in healthcare systems engineering
Audience: Graduate

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 2025
Learning Outcomes: 1. Perform data analysis and propose quality improvement plans
Audience: Both Grad & Undergrad

2. Develop, implement, and interpret advanced control charts for monitoring continuous and discrete quality characteristics and multivariate systems
Audience: Both Grad & Undergrad

3. Implement appropriate data reduction and data processing methods in statistical process control
Audience: Both Grad & Undergrad

4. Apply methods and tools to a real problem-solving experience via a course project
Audience: Graduate

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 2026
Learning Outcomes: 1. Apply knowledge of math, science, and engineering principles to solve manufacturing, service, business, or societal operations problems
Audience: Both Grad & Undergrad

2. Identify, formulate, and solve manufacturing and service operations problems using appropriate data and analytics approaches
Audience: Both Grad & Undergrad

3. Identify opportunities and apply engineering solutions for system productivity and quality improvement
Audience: Both Grad & Undergrad

4. Apply the techniques, skills, and tools for engineering practice, such as modeling, design, simulation, and management
Audience: Both Grad & Undergrad

5. Apply advanced skills and tools for analysis, control and optimization of manufacturing and service systems operations
Audience: Graduate

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 2025
Learning Outcomes: 1. Work effectively on a team-based experiential project focused on process design, analysis, and resource management and integrating the concepts of continual improvement, customer focus, and teamwork
Audience: Graduate

2. Apply problem solving and management/planning tools for effectively defining problems, feasible alternative solutions, and measurable goals in a real-world environment
Audience: Graduate

3. Demonstrate ability to lead an industry-based team project integrating contemporary change management frameworks and considering organizational culture
Audience: Graduate

4. Apply the basics of Factorial Design of Experiments (DOE) as a statistical tool for continuous process improvement
Audience: Graduate

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
Learning Outcomes: 1. Identify the major capabilities and limitations of discrete-event simulation for modeling types of systems that industrial engineers commonly encounter
Audience: Both Grad & Undergrad

2. Model and run discrete-event simulation in practical situations
Audience: Both Grad & Undergrad

3. Identify the main assumptions underlying simulation models, and what can happen when these assumptions do not hold
Audience: Both Grad & Undergrad

4. Apply the results of the modeling process to management and other non-specialist users of engineering analyses
Audience: Both Grad & Undergrad

5. Apply experimental design or data analytics for systems comparison and output analysis of the simulation models
Audience: Both Grad & Undergrad

6. Apply simulation input/output techniques to model complicated stochastic systems such as manufacturing production systems and health care systems
Audience: Graduate

I SY E 623 – ADVANCED OPTIMIZATION MODELING
3 credits.

Translation of problems into optimization models, including how to implement these models in relevant software. Specific topics include techniques to create models of problems with discrete decisions that can be efficiently solved by available software and modeling approaches for problems impacted by uncertainty.
Requisites: I SY E 323 or E C E/COMP SCI/I SY E 524
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Learning Outcomes: 1. Create optimization models for a wide range of realistic problem settings
Audience: Both Grad & Undergrad

2. Write models that can be solved more quickly by available solvers
Audience: Both Grad & Undergrad

3. Implement these models using available software
Audience: Both Grad & Undergrad

4. Provide theoretical explanations for why modeling a problem in a particular way may make it easier to solve using available methods
Audience: Graduate

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 2026
Learning Outcomes: 1. Identify and interpret basic concepts of probability, including random variables, and conditional probability, expectation, and variance
Audience: Both Grad & Undergrad

2. Analyze probability models such as the Markov chains, the exponential distribution, Poisson processes, and queuing models
Audience: Both Grad & Undergrad

3. Identify, formulate, and develop solution techniques for problems that can be modeled by stochastic models in various domains (engineering, computer science, supply chains, healthcare systems, operations research)

Audience: Both Grad & Undergrad

4. Recognize how and when to apply each type of probability model
Audience: Both Grad & Undergrad

5. Formulate mathematical formulations and apply proof techniques
Audience: Graduate

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
Learning Outcomes: 1. Identify decision problems for typical logistics systems
Audience: Both Grad & Undergrad

2. Establish optimization models for typical logistics systems
Audience: Both Grad & Undergrad

3. Use multiple methods to solve logistics system models
Audience: Both Grad & Undergrad

4. Explain the insights of solutions and apply them in realistic situations
Audience: Graduate

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 2026
Learning Outcomes: 1. Recall and state the formal definitions of the mathematical objects and their properties for stochastic processes (e.g., discrete space Markov chains, Poisson processes, renewal processes, branching processes, etc.).
Audience: Both Grad & Undergrad

2. Use such definitions to argue that a mathematical object does or does not have the condition of being a particular type or having a particular property (e.g., irreducibility, aperiodicity, recurrence, transience, the Markov property, etc.).
Audience: Both Grad & Undergrad

3. Recall and state the standard theorems of stochastic processes. (e.g., laws of large numbers for Markov chains, existence of limiting/stationary distributions, law of large numbers for renewal processes, etc.) and recall the arguments for these theorems and the underlying logic of their proofs.

Audience: Both Grad & Undergrad

4. Construct mathematical arguments related to the above definitions, properties, and theorems, including the construction of examples and counterexamples.
Audience: Both Grad & Undergrad

5. Convey arguments in oral and written forms using English and appropriate mathematical terminology, notation and grammar.
Audience: Both Grad & Undergrad

6. Model simple real life situations by means of discrete-space stochastic processes and calculate probabilities associated with those processes.
Audience: Both Grad & Undergrad

7. Identify applications of course content in current areas of research.
Audience: Graduate

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 2026
Learning Outcomes: 1. Identify suitable analysis techniques to investigate processes related to manufacturing, planning, engineering or office operations within a manufacturing firm
Audience: Both Grad & Undergrad

2. Perform analysis to describe, predict and analyze behavior of a manufacturing system to meet desired managerial and economic objectives for a real-world or realistic manufacturing systems improvement project/case study
Audience: Both Grad & Undergrad

3. Develop recommendations that will improve manufacturing system performance (e.g. reduce flow time, increase throughput)
Audience: Both Grad & Undergrad

4. Collaborate effectively in teams to develop solutions to engineering problems and communicate findings effectively
Audience: Both Grad & Undergrad

5. Reflect on personal strengths and weaknesses with respect to team leadership and project management
Audience: Graduate

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
Learning Outcomes: 1. Model a variety of manufacturing problems as stochastic models using Markov Chain and Process theory
Audience: Both Grad & Undergrad

2. Identify the basic assumptions underlying stochastic models and understand what can happen when these assumptions do not hold
Audience: Both Grad & Undergrad

3. Apply queueing theory to model manufacturing systems
Audience: Both Grad & Undergrad

4. Apply the line balancing method for assembly systems design
Audience: Both Grad & Undergrad

5. Perform cost analysis for manufacturing systems
Audience: Both Grad & Undergrad

6. Apply the analytical approaches of performance analysis for manufacturing systems to real industry cases
Audience: Both Grad & Undergrad

7. Apply advanced Markov process method to solve complicated performance evaluation problems encountered in manufacturing production systems
Audience: Graduate

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: Spring 2026
Learning Outcomes: 1. Apply multiple forecasting methods for customer demand
Audience: Undergraduate

2. Identify and apply multiple inventory management models
Audience: Undergraduate

3. Identify the limitation of models and tune them for realistic cases
Audience: Undergraduate

4. Create and present reports for realistic inventory management policy
Audience: Undergraduate

5. Demonstrate ability to lead a team project to optimize realistic supply chain decisions with analytical tools and numerical simulation
Audience: Undergraduate

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 2025
Learning Outcomes: 1. Approach visualization as a design process, using the critical response process and paper prototypes
Audience: Both Grad & Undergrad

2. Design visualizations for different audiences and different purposes
Audience: Both Grad & Undergrad

3. Use the concepts of abstraction and aggregation to translate raw data into meaningful information
Audience: Both Grad & Undergrad

4. Use the flexibility of the grammar of graphics to craft graphs for effective communication
Audience: Both Grad & Undergrad

5. Develop replicable data analyses and visualizations with R and RShiny
Audience: Both Grad & Undergrad

6. Create specialized data analytic visualizations such as time series decompositions and ROC curves
Audience: Graduate

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
Learning Outcomes: 1. Apply the work system model
Audience: Both Grad & Undergrad

2. Apply a variety of models and theories of job and organization design to answer questions such as, "What makes for a good job?" and "What makes for a bad job?"
Audience: Both Grad & Undergrad

3. Apply interview and survey methods for analyzing jobs
Audience: Both Grad & Undergrad

4. Identify approaches to implement job redesign
Audience: Both Grad & Undergrad

5. Identify societal trends related to job design
Audience: Both Grad & Undergrad

6. Identify similarities and differences between various models and theories of job and organization design
Audience: Graduate

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 2025
Learning Outcomes: 1. Explain the access and usability issues that users with physical, sensory, or cognitive impairments due to age or permanent or temporary disability might experience when interacting with everyday products and environmental designs
Audience: Both Grad & Undergrad

2. Apply human factors principles of universal design to describe redesign solutions for common products and environmental designs to improve accessibility for all users
Audience: Both Grad & Undergrad

3. Identify barriers to access for users based on specific disabilities
Audience: Both Grad & Undergrad

4. Articulate common misconceptions and biases related to users with disabilities and use various data sources to discuss the reality of designing for users with disabilities or impairments
Audience: Both Grad & Undergrad

5. Identify usability issues for mass-market products and environmental designs using universal design and basic access principles
Audience: Both Grad & Undergrad

6. Propose methods for improving accessibility and usability using universal design and basic access principles
Audience: Both Grad & Undergrad

7. Articulate how social, institutional, and organizational structures and insufficiently designed systems and environments disadvantage various user groups, with special focus on aging and disabled users
Audience: Graduate

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 2026
Learning Outcomes: 1. Conduct and report on graduate-level industrial engineering research
Audience: Graduate

2. Independently develop industrial engineering research questions
Audience: Graduate

3. Appropriately utilize online and library resources
Audience: Graduate

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: Fall 2025
Learning Outcomes: 1. Identify and respond appropriately to real-life engineering ethics cases relevant to co-op work
Audience: Graduate

2. Synthesize and apply appropriate technical education to real world technical work
Audience: Graduate

3. Communicate effectively in writing and speaking with a range of audiences in the workplace, including those without disciplinary expertise
Audience: Graduate

4. Develop professional and transferable habits like time management skills, collaborative problem-solving skills, and research skills for learning new information
Audience: Graduate

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: Spring 2025
Learning Outcomes: 1. Learn the terms, basic capabilities, and limitations of stochastic programming models
Audience: Graduate

2. Formulate stochastic programming models
Audience: Graduate

3. Implement the algorithms used to solve stochastic programming problems
Audience: Graduate

4. Learn principles of decomposition algorithms for solving large-scale optimization problems
Audience: Graduate

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 2025
Learning Outcomes: 1. Identify basic components, such as the state space, of a dynamic program
Audience: Graduate

2. Formulate and solve dynamic programs under different performance criteria such as finite horizon discounted reward/cost criteria
Audience: Graduate

3. Apply dynamic programming tools and concepts in `traditional' industrial engineering applications such as supply chain, manufacturing, and healthcare
Audience: Graduate

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 2026

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: Spring 2025

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 2026
Learning Outcomes: 1. Describe and explain the basics of polyhedral theory, which consists in the study of systems of linear inequalities both from an algebraic and a geometric point of view
Audience: Graduate

2. Define perfect formulations and identify what properties are desirable in an integer programming formulation of a problem
Audience: Graduate

3. Explain how valid inequalities can be used as cutting planes to strengthen integer programming formulations
Audience: Graduate

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
Learning Outcomes: 1. Evaluate behavioral science literature on individual, group, and organizational decision-making
Audience: Graduate

2. Apply decision-making models to improve managerial performance, system design, and theory development
Audience: Graduate

3. Identify key challenges in behavioral decision-making and their implications for leadership and policy
Audience: Graduate

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: Spring 2026

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 2026
Learning Outcomes: 1. Demonstrate an ability to formulate, analyze, and independently solve advanced industrial engineering problems
Audience: Graduate

2. Communicate research results in writing and/or technical presentations
Audience: Graduate

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 2026
Learning Outcomes: 1. Apply advanced operations research tools to solve a variety of industrial engineering problems
Audience: Graduate

2. Analyze rigorously the methods used in operations research
Audience: Graduate

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
Learning Outcomes: 1. Apply advanced organizational design tools to solve a variety of industrial engineering problems
Audience: Graduate

2. Analyze rigorously the methods used in organizational design
Audience: Graduate

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 2025

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 2025
Learning Outcomes: 1. Apply basic concepts of economic analysis to the assessment of medical technologies and healthcare interventions more broadly
Audience: Graduate

2. Examine health outcomes on a range from objective measures of physical systems to subjective preference-based measures of health utility and describe the benefits and limitations of using quality-adjusted life years (QALYs) as a health outcome measure
Audience: Graduate

3. Explain why we seek to obtain estimates of the "opportunity cost" of using health care resources, describe the process of "costing" in economic assessments of medical technologies and identify useful sources of information for obtaining cost information (and their limitations)
Audience: Graduate

4. Describe how primary data from randomized controlled trials and observational studies can be designed to assess medical technologies and explain the advantages and disadvantages of different designs in terms of their internal and external validity and decision-relevance
Audience: Graduate

5. Describe how evidence from secondary data can be integrated using meta-analysis and decision-analytic modeling methods to assess medical technologies and demonstrate basic ability to design and execute simple decision tree and Markov models for cost-effectiveness analysis
Audience: Graduate

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 2026
Learning Outcomes: 1. Demonstrate an ability to formulate, analyze, and independently solve advanced industrial engineering problems
Audience: Graduate

2. Communicate research results in writing and/or technical presentations
Audience: Graduate

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 2026
Learning Outcomes: 1. Identify and describe modern challenges in industrial engineering
Audience: Graduate

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 2026
Learning Outcomes: 1. Demonstrate an ability to formulate, analyze, and independently solve advanced industrial engineering problems
Audience: Graduate

2. Communicate research results in writing and/or technical presentations
Audience: Graduate

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
Learning Outcomes: 1. Conduct and report on graduate-level industrial engineering research
Audience: Graduate

2. Independently develop industrial engineering research questions
Audience: Graduate

3. Appropriately utilize online and library resources
Audience: Graduate