

Industrial and Systems Engineering (ISE)

ISE 1000: Introduction to Industrial Engineering

Introduction to industrial engineering profession, the Industrial and Systems Engineering department, and the core topics of industrial engineering. Introduction to problem solving, ethics and industrial engineering design and analysis techniques. Graded on A-F basis only.

Credit Hour: 1

ISE 2030: Fundamentals of Systems Design and Analysis

An introduction to a systems engineering approach for designing, integrating, and managing complex systems (financial, healthcare, logistics, manufacturing, service, etc.) over their lifecycle. This includes system modeling, specification, structured problem solving, system design methodology, and the application of artificial intelligence to address the trade-offs between system performance, lifecycle cost, and operability/reliability. Graded on A-F basis only.

Credit Hours: 3

Prerequisites: MATH 1500

ISE 2110: Probability and Statistics for Engineers

Introduction to data analysis, probability concepts, random variables, parameter estimation and hypothesis testing.

Credit Hours: 3

Prerequisites: MATH 1500. Restricted to Engineering Students who are non-IMSE majors

ISE 2210: Linear Algebra for Engineers

Study of quantitative methods necessary for analysis, modeling and design of optimal industrial systems.

Credit Hours: 3

Prerequisites: MATH 1700

ISE 2710: Engineering Economic Decision-Making

Fundamentals of economic decision-making from an engineering perspective. Includes conceptual basis of economic analysis (interest, inflation), principles for decision making (cost/benefits, breakeven analysis, risk and uncertainty, multi-objectives/attributes), generation of engineering economic parameters (life-cycle analysis), and the application of economic decision making in different context (governmental policy, time-phased, and scarce capital).

Credit Hours: 3

Prerequisites: sophomore standing

ISE 3030: Manufacturing and Supply Systems

Provide a structured approach for the design and optimization of a system throughout its lifecycle: techniques following the logical sequence of strategic analysis, system design, implementation, and monitoring.

Credit Hours: 3

Prerequisites: ISE 2030

ISE 3110: Probability Models for Engineers

Introduction to probability concept and theory, random variables, discrete and continuous probability distributions, joint probability distributions. Graded on A-F basis only.

Credit Hours: 3

Prerequisites: Grade of C- or better in MATH 1500

ISE 3110H: Probability Models for Engineers - Honors

Introduction to probability concept and theory, random variables, discrete and continuous probability distributions, joint probability distributions. Honors eligibility required

Credit Hours: 3

Prerequisites: Grade of C or better in MATH 1500

ISE 3500: Introduction to Manufacturing Methods

(same as MAE 3500). This course is an introduction to the engineering principles of manufacturing processes, ranging from traditional to state-of-the-art. The course will emphasize material processing, selection, and design considerations for manufacturing. The course introduces critical aspects of manufacturing process engineering through a combination of lectures, videos, class discussions, and case studies to engage students. By the end of the course, students are expected to learn the fundamentals of manufacturing and manufacturing processes. Graded on A-F basis only.

Credit Hours: 2

Prerequisites or Corequisites: ENGINR 2200

Prerequisites: MAE 1100

ISE 3505: Computer Aided Design and Manufacturing Processes

Laboratory

This course covers the product realization process from design, process planning, to manufacturing, including CE, DFA/DFM, CAD, CAPP, CAM, CNC. The course uses active learning with hands-on laboratory projects, videos, and class discussions. By the end of the course, students will learn the fundamentals of manufacturing and manufacturing processes, and the product realization process from CAD to CAM, primarily through concept learning and hands-on laboratory exercises. Graded on A-F basis only.

Credit Hours: 2

Prerequisites: MAE 1100; Junior standing; restricted to IMSE students

Corequisites: ISE 3500 or MAE 3500

ISE 3530: Industrial Robotics

An experiential industrial robotics course that will take students from fundamentals to intermediate programming of multiple industrial robotic systems. Students will learn with both six-axis articulated arm robots and state-of-the-art collaborative robots. Additionally, students will explore conceptual and applied machine vision concepts utilizing industrial machine vision systems. Graded on A-F basis only.

Credit Hours: 3

Prerequisites: PHYSCS 2760

ISE 3810: Ergonomics and Workstation Design

Ergonomics and human factors theories applied to the design of man-machine systems. Discussion of ergonomic methods for measurement, assessment, and evaluation, with major topics including workstation design, environmental stresses, and workplace safety. Includes lab.

Credit Hours: 3

Prerequisites: Restricted to IMSE students. ENGINR 1200 and ISE 4110

ISE 3810W: Ergonomics and Workstation Design - Writing Intensive

Ergonomics and human factors theories applied to the design of man-machine systems. Discussion of ergonomic methods for measurement, assessment, and evaluation, with major topics including workstation design, environmental stresses, and workplace safety. Includes lab.

Prerequisites:

Credit Hours: 3

Prerequisites: Restricted to IMSE students. ENGINR 1200 and ISE 4110

ISE 4001: Topics in Industrial and Systems Engineering

Current and new technical developments in industrial engineering.

Credit Hours: 3

ISE 4085: Problems in Industrial Engineering

Supervised investigation in industrial engineering presented in form of an engineering report.

Credit Hour: 1-4

ISE 4110: Engineering Statistics

(cross-leveled with ISE 7110). Understanding and application of statistical analysis techniques. Emphasis on hypothesis testing, regression

analysis, analysis of variance (ANOVA) and design of experiments (DOE).

Credit Hours: 3

Prerequisites: Restricted to IMSE students or by Departmental consent. Grade of C- or better in ISE 3110

ISE 4210: Deterministic Models in Operations Research

(cross-leveled with ISE 7210). Theory and application of linear, network and integer optimization. Graded on A-F basis only.

Credit Hours: 3

Prerequisites: Restricted to ISE students. Grade of C- or better in ISE 2210

ISE 4220: Optimization Modeling and Computational Methods

(cross-leveled with ISE 7220). Modeling and solution techniques for mathematical optimization, including linear, nonlinear, integer, and stochastic programming. Emphasis on formulation of models for most-efficient use of solution algorithms. Graded on A-F basis only.

Credit Hours: 3

Prerequisites: ISE 3110, ISE 4210

ISE 4230: Stochastic Models in Operations Research

(cross-leveled with ISE 7230). Formulates probabilistic models and determines optimal control policies for queuing and inventory systems. Introduces Markov chains and dynamic programming.

Credit Hours: 3

Prerequisites: Restricted to IMSE students or by Departmental consent. Grade of C- or better in ISE 2210 and ISE 3110

ISE 4280: Systems Simulation

(cross-leveled with ISE 7280). Discrete-event stochastic systems modeling and experimentation using simulation software. Statistical design and analysis including distribution fitting and alternative comparison methodologies.

Credit Hours: 3

Prerequisites: Restricted to IMSE students. Grade of C- or better in ISE 4110

ISE 4310: Integrated Production Systems Design

(cross-leveled with ISE 7310). Design and operation of production systems, including lean six sigma concepts, just-in-time/kanban, facility layout and material flow issues.

Credit Hours: 3

Prerequisites: Restricted to IMSE students or by Departmental consent. ISE 2030, ISE 2710, ISE 4210, ISE 4280

ISE 4330: Material Flow and Logistics System Design

(cross-leveled with ISE 7330). Modeling and analysis of structural and operational issues associated with material-flow system design including facility location, warehouse/inventory systems, and distribution/transportation systems.

Credit Hours: 3**Prerequisites:** ISE 4210 and ISE 4280**ISE 4350: Production and Operations Analysis**

(cross-leveled with ISE 7350). Quantitative methods for forecasting, scheduling, and production control in manufacturing and service systems. Use of Enterprise Resource Planning (ERP) systems.

Credit Hours: 3**Prerequisites:** Restricted to IMSE students or by Departmental consent. ISE 4210 and ISE 4230**ISE 4360: Supply Chain Engineering**

(cross-leveled with ISE 7360). Modeling and analysis of supply chain network design and management issues including integration of production, inventory control, supplier selection, risk management and logistics network design. Graded on A-F basis only.

Credit Hours: 3**Prerequisites:** ISE 4350**ISE 4370: Service Systems Engineering and Management**

(cross-leveled with ISE 7370). Service systems contribute to more than 75% of US GDP and provide close to 80% employment. This course introduces students to service system engineering and management and will discuss models, concepts and solution methods important in the design, control, and operation of service systems. In addition, this course will provide students the ability to apply industrial engineering and operations research tools for analyzing service enterprises, including supply chain engineering, financial engineering and revenue management. Graded on A-F basis only.

Credit Hours: 3**Prerequisites:** ISE 4210 or instructor's consent**ISE 4380: Six Sigma Methodology**

(cross-leveled with ISE 7380). An overview of the Six Sigma DMAIC methodology for analyzing and improving processes. Requires completing a Six Sigma Green Belt project. Graded on A-F basis only.

Credit Hours: 3**Prerequisites:** Grade of C or better in ISE 2110 or ISE 4110 or STAT 4710**ISE 4385: Lean Six Sigma Green Belt Project**

(cross-leveled with ISE 7385). Application of the Lean Six Sigma methodology in an industry-based project.

Credit Hour: 1**Prerequisites:** ISE 4310**ISE 4410: Data Engineering and Predictive Modeling**

(cross-leveled with ISE 7410). Introduces the science of processing data using expert systems for faster and smarter decision-making. Topics covered include descriptive analytics, statistical learning algorithms, tree-based algorithms, artificial neural networks, association rule mining, and k-means clustering.

Credit Hours: 3**Prerequisites:** INFOTC 4401 or CMP_SC 1050, and ISE 4110**ISE 4420: Web-Based Information Systems**

(cross-leveled with ISE 7420). Data models, design of databases using E-R, UML (Access/Oracle), web databases, web servers and interfaces (Visual Basic, JavaScript), E-commerce infrastructure (PDM, STEP, XML), data mining for management information and services.

Credit Hours: 3**Prerequisites:** ISE 4410 and instructor's consent**ISE 4500: Introduction to Manufacturing Processes**

(cross-leveled with ISE 7500). An introduction to the engineering principles of manufacturing processes, ranging from traditional (casting, forming, cutting, welding) to the state-of-the-art (additive). The course will emphasize material selection, process analysis and selection, and product design considerations for manufacturing. Graded on A-F basis only.

Credit Hours: 3**Prerequisites or Corequisites:** ENGINR 2200 or MAE 2200**Prerequisites:** MAE 1100**ISE 4550: Computer Aided Design and Manufacturing**

(cross-leveled with ISE 7550). Product realization process from design, process planning, to manufacturing. Includes CE, DFS/DFM, CAD, CAPP, CNC, and survey of manufacturing methods.

Credit Hours: 4**Prerequisites:** Restricted to IMSE students; Junior Standing**Corequisites:** ENGINR 2200**ISE 4560: Introduction to Rapid Prototyping**

(cross-leveled with ISE 7560). Course covers all five MU systems: FDM, SLS, SLA, Polyjet, 3DP. Students will learn fundamental rapid prototyping

and related concepts, and design and produce models from each system. Graded on A-F basis only.

Credit Hours: 3

Prerequisites: ISE 4550

ISE 4565: Smart Manufacturing Systems

(cross-leveled with ISE 7565). A lab-based introduction to smart manufacturing systems design and operation with respect to Industry 4.0. Course topics include: Industrial Internet of Things (IIoT), cyber-physical systems (CPS), artificial intelligence (AI), digital twins (DT), industrial automation and robotics, and cybersecurity in smart manufacturing. Graded on A-F basis only.

Credit Hours: 3

Prerequisites: ISE 4570

ISE 4570: Industrial Automation and Control

(cross-leveled with ISE 7570). Examination of industrial automation that covers the fundamental concepts of automation using industrial sensors, transducers, and instrumentation - to system integration with PLCs (programmable logic controllers) utilizing state-of-the-art programming software. The course utilizes experiential learning with hands-on laboratory projects to explore concepts in industrial automation and control. Graded on A-F basis only.

Credit Hours: 3

Prerequisites: PHYSCS 2760

ISE 4580: Industrial Energy Efficiency and Management

(cross-leveled with ISE 7580). Introduction to the fundamentals of industrial energy efficiency and management. Covers the essential concepts, best practices, management systems and current standards to achieve and improve energy efficiency in industrial settings, and utilizes hands-on experiences involving real assessment and analysis of industrial site visits and projects.

Credit Hours: 3

Prerequisites: ISE 2030 or instructor's consent

ISE 4610: Quality Engineering and Analytics

(cross-leveled with ISE 7610). Introduces concepts, theory, and analytical methodologies for quality planning, improvement, and control in manufacturing and service systems. Topics covered include process quality modeling, hypothesis testing, control charts, capability analysis, data visualization, text analytics.

Credit Hours: 3

Prerequisites: Restricted to IMSE students or by Departmental consent. ISE 4110. INFOTC 4401

ISE 4710: Introduction to Sales Engineering

Introduces the sales engineering profession. Overview of sales engineering in the different engineering disciplines. An introduction to problem-solving and sales engineering processes is covered. Various forms of technical and social communication are emphasized throughout the course. Graded on A-F basis only.

Credit Hours: 3

Prerequisites: Junior standing required

ISE 4720: Introduction to Life Cycle Analysis

(cross-leveled with ISE 7720). Introduction to life cycle thinking, application of ISO standards for conducting an LCA. Students learn process, input-output and hybrid LCA modeling basics, in addition to the application of LCA skills and thinking to improve the performance of systems and processes. Graded on A-F basis only.

Credit Hours: 3

Prerequisites: Junior standing

ISE 4750: Entrepreneurial Innovation Management: Enterprise Conception

(cross-leveled with ISE 7750). Develop a new business and technology plan including marketing, finance, engineering, manufacturing, and production concepts in this joint College of Engineering and College of Business course.

Credit Hours: 3

Prerequisites: sophomore standing

ISE 4755H: Entrepreneurial Innovation Management: Enterprise Conception-Honors

Develop a new business and technology plan including marketing, finance, engineering, manufacturing, and production concepts in this joint College of Engineering and College of Business course.

Credit Hours: 3

Prerequisites: sophomore standing. Honors eligibility required

ISE 4810: Cognitive Ergonomics

(cross-leveled with ISE 7810). This course will cover the study of empirical research in Cognitive ergonomics and Human-Computer Interaction (HCI). Students will learn cognitive information processing, mental workload, human reliability, and empirical methods in HCI research. Graded on A-F basis only.

Credit Hours: 3

Recommended: Junior or senior level undergraduate students

ISE 4910: Industrial Engineering Internship

An industry-based learning experience that provides opportunities to apply industrial engineering skills, concepts and theories in a practical context. Requires submission of an internship plan for prior approval and a final oral presentation / written report at the completion of the internship. Graded on A-F basis only.

Credit Hours: 3

Prerequisites: instructor and departmental consent

Recommended: junior standing

ISE 4920: Industrial Engineering COOP

An industry-based learning experience that provides opportunities to apply industrial engineering skills, concepts and theories in a practical context. Requires submission of a COOP plan for prior approval and a final oral presentation / written report at the completion of the COOP. Graded on A-F basis only.

Credit Hours: 3

Prerequisites: instructor and departmental consent

Recommended: junior standing

ISE 4970: Capstone Design I

Overview of professional engineering issues such as ethics, team dynamics, communication, and project management. Includes team-based industrial assessments to develop skills in problem/opportunity identification. Graded on A-F basis only.

Credit Hour: 1

Prerequisites or Corequisites: ISE 4310

Prerequisites: Restricted to IMSE students; Senior Standing

ISE 4970W: Capstone Design I - Writing Intensive

Overview of professional engineering issues such as ethics, team dynamics, communication, and project management. Includes team-based industrial assessments to develop skills in problem/opportunity identification. Graded on A-F basis only.

Credit Hour: 1

Prerequisites or Corequisites: ISE 4310

Prerequisites: Restricted to IMSE students; Senior Standing

ISE 4980: Capstone Design II

Industry-based team design experience structured to integrate material presented throughout the Industrial and Manufacturing Systems Engineering curriculum. Must immediately follow ISE 4970.

Credit Hours: 3

Prerequisites: Restricted to IMSE student; ISE 3810, ISE 4310, and ISE 4970

ISE 4980W: Capstone Design II - Writing Intensive

Industry-based team design experience structured to integrate material presented throughout the Industrial and Manufacturing Systems Engineering curriculum. Must immediately follow ISE 4970.

Credit Hours: 3

Prerequisites: Restricted to IMSE student; ISE 3810, ISE 4310, and ISE 4970

ISE 4990: Undergraduate Research in Industrial Engineering

Independent investigation or project in industrial engineering. May be repeated to 6 hours.

Credit Hour: 0-6

ISE 4995: Undergraduate Research Industrial Engineering - Honors

Independent investigation or project in industrial engineering. May be repeated to 6 hours. Enrollment limited to receiving departmental honors

Credit Hour: 0-6

Prerequisites: Restricted to IMSE students only

ISE 4995H: Undergraduate Research Industrial Engineering - Honors

Independent investigation or project in industrial engineering. May be repeated to 6 hours. Enrollment limited to receiving departmental honors

Credit Hour: 0-6

Prerequisites: Restricted to IMSE students only

ISE 7001: Topics in Industrial and Systems Engineering

Current and new technical developments in industrial engineering.

Credit Hours: 3

ISE 7110: Engineering Statistics

(cross-leveled with IMSE 4110). Understanding and application of statistical analysis of techniques. Emphasis on hypothesis testing, regression analysis, analysis of variance (ANOVA) and design of experiments (DOE).

Credit Hours: 3

Prerequisites: grade of C- or better in ISE 3110

ISE 7210: Deterministic Models in Operations Research

(cross-leveled with ISE 4210). Theory and application of linear, network and integer linear optimization. Graded on A-F basis only.

Credit Hours: 3

Prerequisites: ISE 2210

ISE 7220: Optimization Modeling and Computational Methods
(cross-leveled with ISE 4220). Modeling and solution techniques for mathematical optimization, including linear, nonlinear, integer, and stochastic programming. Emphasis on formulation of models for most-efficient use of solution algorithms. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: ISE 3110, ISE 4210

ISE 7230: Stochastic Models in Operations Research
(cross-leveled with ISE 4230). Formulates probabilistic models and determines optimal control policies for queuing and inventory systems. Introduces Markov chains and dynamic programming.

Credit Hours: 3
Prerequisites: grade of C- or better in ISE 2110 and ISE 3110

ISE 7280: Systems Simulation
(cross-leveled with ISE 4280). Discrete-event stochastic systems modeling and experimentation using simulation software. Statistical design and analysis including distribution fitting and alternative comparison methodologies. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: Restricted to IMSE students. Grade of C- or better in ISE 4110

ISE 7310: Integrated Production Systems Design
(cross-leveled with ISE 4310). Design and operation of production systems, including lean production concepts, just-in-time / kanban, facility layout and material flow issues.

Credit Hours: 3
Prerequisites: ISE 2030, ISE 2710, ISE 4210, ISE 4280

ISE 7330: Material Flow and Logistics System Design
(cross-leveled with ISE 4330). Modeling and analysis of structural and operational issues associated with material-flow system design including facility location, warehouse/inventory systems, and distribution/transportation systems.

Credit Hours: 3
Prerequisites: ISE 4210, ISE 4280

ISE 7350: Production and Operations Analysis
(cross-leveled with ISE 4350). Quantitative methods for forecasting, scheduling, and production control in manufacturing and service systems. Use of Enterprise Resource Planning (ERP) systems.

Credit Hours: 3
Prerequisites: ISE 4210 and ISE 4230

ISE 7360: Supply Chain Engineering
(cross-leveled with ISE 4360). Modeling and analysis of supply chain network design and management issues including integration of production, inventory control, supplier selection, risk management and logistics network design. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: ISE 4350

ISE 7370: Service Systems Engineering and Management
(cross-leveled with ISE 4370). Service systems contribute to more than 75% of US GDP and provide close to 80% employment. This course introduces students to service system engineering and management and will discuss models, concepts and solution methods important in the design, control, and operation of service systems. In addition, this course will provide students the ability to apply industrial engineering and operations research tools for analyzing service enterprises, including supply chain engineering, financial engineering and revenue management. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: ISE 4210 or Instructor's consent

ISE 7380: Six Sigma Methodology
(cross-leveled with ISE 4380). An overview of the Six Sigma DMAIC methodology for analyzing and improving processes. Requires completing a Six Sigma Green Belt project. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: Grade of C or better in ISE 2110 or ISE 4110 or STAT 4710

ISE 7385: Lean Six Sigma Green Belt Project
(cross-leveled with ISE 4385). Application of the Lean Six Sigma methodology in an industry-based project.

Credit Hour: 1
Prerequisites: ISE 4310

ISE 7410: Data Engineering and Predictive Modeling
(cross-leveled with ISE 4410). Introduces the science of processing data using expert systems for faster and smarter decision-making. Topics covered include descriptive analytics, statistical learning algorithms, tree-based algorithms, artificial neural networks, association rule mining, and k-means clustering. Graded on A-F basis only.

Credit Hours: 3

Prerequisites: INFOTC 4401, CMP_SC 1050 and ISE 4110

ISE 7420: Web-Based Information Systems

(cross-leveled with ISE 4420). Data models, design of databases using E-R, UML (Access/Oracle), web databases, web servers and interfaces (Visual Basic, JavaScript), E-commerce infrastructure (PDM, STEP, XML), data mining for management information and services.

Credit Hours: 3

Prerequisites: ISE 4410 and instructor's consent

ISE 7500: Introduction to Manufacturing Processes

(cross-leveled with ISE 4500). An introduction to the engineering principles of manufacturing processes, ranging from traditional (casting, forming, cutting, welding) to the state-of-the-art (additive). The course will emphasize material selection, process analysis and selection, and product design considerations for manufacturing. Graded on A-F basis only.

Credit Hours: 3

Prerequisites: MAE 1100, and ENGINR 2200 or MAE 2200

ISE 7510: CAD/CAM Laboratory

A laboratory that includes the product realization process from design, process planning, to manufacturing. Includes CE, DFS/DFM, CAD, CAPP, CNC, and the application of applicable manufacturing methods. Graded on A-F basis only.

Credit Hour: 1

Corequisites: ISE 7500

ISE 7550: Computer Aided Design and Manufacturing

(cross-leveled with ISE 4550). Product realization process from design, process planning, to manufacturing. Includes CE, DFS/DFM, CAD, CAPP, CNC, and survey of manufacturing methods.

Credit Hours: 4

ISE 7560: Introduction to Rapid Prototyping

(cross-leveled with ISE 4560). Course covers all five MU systems: FDM, SLS, SLA, Polyjet, 3DP. Students will learn fundamental rapid prototyping and related concepts, and design and produce models from each system. Graded on A-F basis only.

Credit Hours: 3

ISE 7565: Smart Manufacturing Systems

(cross-leveled with ISE 4565). A lab-based introduction to smart manufacturing systems design and operation with respect to Industry 4.0. Course topics include: Industrial Internet of Things (IIoT), cyber-physical

systems (CPS), artificial intelligence (AI), digital twins (DT), industrial automation and robotics, and cybersecurity in smart manufacturing. Graded on A-F basis only.

Credit Hours: 3

Prerequisites: ISE 7570

ISE 7570: Industrial Automation and Control

(cross-leveled with ISE 4570). Examination of industrial automation that covers the fundamental concepts of automation using industrial sensors, transducers, and instrumentation - to system integration with PLCs (programmable logic controllers) utilizing state-of-the-art programming software. The course utilizes experiential learning with hands-on laboratory projects to explore concepts in industrial automation and control. Graded on A-F basis only.

Credit Hours: 3

Prerequisites: PHYSCS 2760

ISE 7580: Industrial Energy Efficiency and Management

(cross-leveled with ISE 4580). Introduction to the fundamentals of industrial energy efficiency and management. Covers the essential concepts, best practices, management systems and current standards to achieve and improve energy efficiency in industrial settings, and utilizes hands-on experiences involving real assessment and analysis of industrial site visits and projects.

Credit Hours: 3

Prerequisites: ISE 2030 or instructor's consent

ISE 7610: Quality Engineering and Analytics

(cross-leveled with ISE 4610). Introduces concepts, theory, and analytical methodologies for quality planning, improvement, and control in manufacturing and service systems. Topics covered include process quality modeling, hypothesis testing, control charts, capability analysis, data visualization, text analytics. Graded on A-F basis only.

Credit Hours: 3

Prerequisites: ISE 4110 or ISE 7110. INFOTC 4401 or other Python programming course

ISE 7720: Introduction to Life Cycle Analysis

(cross-leveled with ISE 4720). Introduction to life cycle thinking, application of ISO standards for conducting an LCA. Students learn process, input-output and hybrid LCA modeling basics, in addition to the application of LCA skills and thinking to improve the performance of systems and processes. Graded on A-F basis only.

Credit Hours: 3

ISE 7750: Entrepreneurial Innovation Management: Advanced Enterprise Conception

(cross-leveled with ISE 4750). Develop a new business and technology plan (including marketing, finance, engineering, manufacturing, and production concepts) in this joint College of Engineering/College of Business course.

Credit Hours: 3**ISE 7810: Cognitive Ergonomics and Decision Making**

(cross-leveled with ISE 4810). This course will cover the study of empirical research in cognitive ergonomics and Human-Computer Interaction (HCI). Students will learn cognitive information processing, mental workload, human reliability, decision-making, and empirical methods in HCI research. Graded on A-F basis only.

Credit Hours: 3**ISE 8001: Advanced Topics in Industrial & Systems Engineering**

Current and new technical developments in industrial engineering.

Credit Hours: 3**ISE 8030: Advanced Manufacturing and Supply Systems**

The design, regulation, and optimization of manufacturing and supply systems through systems analysis.

Credit Hours: 3**ISE 8085: Problems in Industrial and Systems Engineering**

Supervised investigation in industrial engineering to be presented in the form of an engineering report. Graded on A-F basis only.

Credit Hour: 1-6**ISE 8087: Industrial Engineering Graduate Seminar**

Selected topics in industrial engineering; oral presentations and engineering reports. Graded on S/U basis only.

Credit Hours: 0**ISE 8110: Design and Analysis of Engineering Experiments**

Application of advanced statistical methods for the design and analysis of experiments, including two-level factorial designs and fractional factorial designs, response surface methods, and random effects models. Graded on A-F basis only.

Credit Hours: 3**Prerequisites:** ISE 4110 or ISE 7110 or equivalent**ISE 8210: Linear and Network Optimization**

Applications of discrete operations research methods, including linear programming, network models, fuzzy sets, integer programming, and meta-heuristics. Graded on A-F basis only.

Credit Hours: 3**ISE 8220: Nonlinear Optimization**

Introduces computational non-linear mathematical programming procedures their use in solving complex industrial systems design problems. Graded on A-F basis only.

Credit Hours: 3**ISE 8230: Stochastic Processes and Models**

Theory and applications of stochastic processes; includes continuous time Markov chain, Markov decision process, queueing theory, and stochastic manufacturing systems. Graded on A-F basis only.

Credit Hours: 3**ISE 8310: Advanced Integrated Production Systems**

Advanced study of the design and operation of flow shop, job shop, and cell-based production systems, including scheduling, layout and material flow issues. Graded on A-F basis only.

Credit Hours: 3**ISE 8370: Supply Chain Modeling and Analysis**

Theory and application of supply chain networks, integration of production and inventory control methods. Graded on A-F basis only.

Credit Hours: 3**ISE 8410: Advanced Analytics with Engineering Applications**

Introduces the core principles, methods, and tools associated with data analytics and provides hands-on training using Python and R. The course covers advanced tools/techniques for data summarization, visualization, predictive modeling, association mining, clustering, and natural language processing. Graded on A-F basis only.

Credit Hours: 3**ISE 8550: Advanced CAD/CAM**

Covers the state-of-the-art in CAD/CAM and explores the latest developments, residual problems, and new direction in CAD/CAM. Includes sculptured surface modeling, rapid prototyping and

manufacturing, integrated process planning, shape analysis, machine intelligence. Graded on A-F basis only.

Credit Hours: 3

ISE 8560: Advanced Manufacturing Technologies

The fundamental theory, design, fabrication, and analysis of state-of-the-art manufacturing technologies will be covered in this course. The course will emphasize production design, CAD/CAM, material selection, and material processing technologies, including traditional machining methods, rapid prototyping and manufacturing, integrated process planning, shape analysis, and cutting-edge Micro/Nanofabrication techniques. The course uses active learning with hands-on projects, videos, and class discussions to help students understand manufacturing principles and product realization methods. Graded on A-F basis only.

Credit Hours: 3

ISE 8730: Strategic Enterprise Management

Topics including enterprise strategies, process and content models, strategy implementation, value chain analysis, business processes, systems engineering approaches, business process reengineering, and dynamic systems modeling.

Credit Hours: 3

ISE 8810: Human Factors

Human factors inputs, outputs and environment and their influence on design and evaluation of man and machine systems.

Credit Hours: 3

ISE 8990: Research-Masters Thesis in Industrial Engineering

Independent investigation in field of industrial engineering to be presented as a thesis. Graded on S/U basis only.

Credit Hour: 1-99

ISE 9990: Research-Doctoral Dissertation in Industrial Engineering

Independent investigation in field of industrial engineering to be presented as a dissertation. Graded on S/U basis only.

Credit Hour: 1-99
