INDUSTRIAL AND SYSTEMS ENGINEERING (ISE)

ISE 2321 Statistical Methods for Process and Quality Control (3 credits)
Study of modern quality management philosophies and methods applied to design, manufacturing, service, and delivery. Emphasis on statistical quality control, process capability, loss functions, and designed experiments for process improvement. Topics include total quality management, ISO 9000, the Baldrige framework, and an introduction to machine learning and big data methods. Typically Offered: Fall.
Prereqs: STAT 3010

ISE 3311 Introduction to Operations Research (3 credits)
Introduction to operations research techniques, including linear, dynamic, and integer programming, as well as the traveling salesman, transportation, and assignment problems under conditions of certainty. Survey of fundamental probabilistic models and their applications to operations research, industrial systems, manufacturing, and processes involving uncertainty. Typically Offered: Fall.
Prereqs: STAT 3010 and MATH 3300

ISE 3312 Model-Based Simulation and Decision Support Systems (3 credits)
Use of discrete-event simulation and Monte-Carlo simulation for modeling and analyzing complex systems under uncertainty. Emphasis is placed on designing and analyzing simulation experiments. Applications include queuing, inventory control, and production planning, along with an introduction to simulation languages, software, and statistical analysis. Typically Offered: Spring.
Prereqs: ISE 2321 and ETEC 3530

ISE 3331 Work Systems Engineering (3 credits)
Foundational and modern principles and techniques for workplace design, cognitive ergonomics, work design, measurement, work sampling, predetermined time systems, and human-machine interfaces. Basic human factors engineering and ergonomics principles applied to workplace and work design and interaction with AI-enabled technologies. Typically Offered: Spring.
Prereqs: STAT 3010 and junior standing in engineering

ISE 3361 Information Systems Engineering (3 credits)
Introduction to the design of enterprise information systems architecting and its applications to engineering and scientific systems. Overview of requirements definition, enhanced entity relationship modeling, logical modeling, structured query language, relational models, referential integrity. Application of large language models in data queries input and output translation. Typically Offered: Spring.
Prereqs: ENGR 2120 and MATH 3300

ISE 3362 Operational Excellence (3 credits)
Design, implementation, and evaluation of modern operational excellence methodologies such as lean manufacturing and six sigma. Theory, methods, and techniques of operational excellence methodologies applied into production, manufacturing, service, and delivery systems. Examine the impact of operational excellence implementations in industrial processes, equipment, technology, and decision support systems. Typically Offered: Spring.
Prereqs: ISE 2321 and ETEC 3530 Prereqs or
Coreqs: ISE 3331

ISE 4322 Experimental Design and Analysis of Industrial Processes (3 credits)
Joint-listed with ISE 5322
Analyze and improve operational systems through the application of statistical inference methods and basic empirical model development. Hypothesis testing, confidence intervals, tolerance interval, bootstrap confidence intervals, and basic linear regression are applied to industrial engineering applications. Design and analysis of observational and factorial experiments employing numerical and graphical methods. Introduction to machine learning and big data methods. Additional work required for graduate students. Typically Offered: Spring and Varies.
Prereqs: ISE 2321

ISE 4341 Artificial Intelligence/Machine Learning Integration for ISE (3 credits)
An applied course examining how artificial intelligence and machine learning technologies augment the work of ISEs across manufacturing, logistics, healthcare, and service domains. Students survey relevant AI/ML methods such as supervised learning, optimization, computer vision, and large language models. Students will learn to identify appropriate applications for ISE problem contexts such as predictive maintenance, process optimization, and resource allocation. Ethical considerations, workforce impacts, and stakeholder communication are addressed throughout. Typically Offered: Spring.
Prereqs: ISE 2321, ISE 3331, ISE 3361, and ISE 3362

ISE 4363 Production, Distribution, and Inventory Planning and Control (3 credits)
Joint-listed with ISE 5363
Forecasting techniques, inventory analysis, master production scheduling, material and capacity requirements, planning and scheduling methods. Additional work required for graduate students. Typically Offered: Fall and Varies.
Prereqs: ISE 3311, ISE 3312, and ISE 3361

ISE 4364 Facilities Design and Material Handling (3 credits)
Design and analysis of industrial, manufacturing, service, and delivery facilities including just-in-time systems, queuing, material handling systems, material flow analysis, line balancing, systematic layout planning, design of warehouse facilities, and facilities location. Supply chain management. Typically Offered: Spring.
Prereqs: ISE 4363

ISE 4371 Engineering Project Management (3 credits)
Joint-listed with ISE 5371
Critical issues in the management of engineering and high-technology projects are discussed. Time, cost, and performance parameters are analyzed from the organizational, people, and resource perspectives. Network optimization and simulation concepts are introduced. Resource-constrained project scheduling case discussions and a term project are included. Additional work required for graduate students. Typically Offered: Fall and Varies.
Prereqs: Junior standing in engineering or instructor's permission

ISE 4372 Manufacturing Costing Systems (3 credits)
Costing techniques applicable in production, manufacturing, service, and delivery enterprises: activity-based costing, economic value added, Japanese cost management techniques, life cycle costing, throughput accounting, cost of quality, and financial versus operational performance measures. Typically Offered: Fall and Varies.
Prereqs: ETEC 3530 and ENGR 3600

ISE 4381 Approaches to Managing Complex Systems (3 credits)
Joint-listed with ISE 5381
Improvement of organizational performance through the use and application of management systems engineering principles. Design and implementation of performance measurement systems that integrate personnel, technological, environmental, and organizational variables. Topics include performance assessment and measurement, systems approaches to managing complexity, and organizational design principles. Additional work required for graduate students. Typically Offered: Fall and Varies.
Prereqs: ISE 3331, ISE 3312, ISE 3361, and ISE 3362

ISE 4397 Industrial & Systems Engineering Capstone I (3 credits)
Address a customer's needs by determining the objective to be achieved (e. g. , help a real-world client design or improve a system). Application of Elegant Design principles will guide the solution system design process, discovery of system requirements, identification of project scope and technical risks, and development of a project plan and schedule. Students will communicate orally and in writing their progress. This is the first part of a two-course series. Typically Offered: Fall.
Prereqs: ISE 3331, ISE 3312, ISE 3361, and ISE 3362

ISE 4398 Industrial & Systems Engineering Capstone II (3 credits)
Address a customer's needs by determining the objective to be achieved (e. g. , help a real-world client design or improve a system). Application of Elegant Design principles will guide the solution system design process, discovery of system requirements, identification of project scope and technical risks, and development of a project plan and schedule. Students will communicate orally and in writing their progress. This is the second part of a two-course series. Typically Offered: Spring.
Prereqs: ISE 4372, ISE 4381, and ISE 4397

ISE 5000 Master's Research and Thesis (1-16 credits, max 99)
Credit arranged

ISE 5020 (s) Directed Study (1-16 credits, max 99)
Credit arranged

ISE 5040 (s) Special Topics (1-16 credits, max 99)
Credit arranged

ISE 5185 Capstone Integration (1 credit)
Cross-listed with EM 5960
Capstone integration of degree material in engineering management and comprehensive final exam. Graded Pass/Fail. Typically Offered: Varies.
Prereqs: Permission

ISE 5313 Survey of Operations Research (3 credits)
Survey of advanced operations research techniques for modeling, analyzing, and optimizing complex industrial and enterprise systems. Topics include linear, integer, nonlinear, and stochastic optimization methods. Emphasis is placed on formulating real-world problems, selecting appropriate solution techniques, and interpreting results to support strategic and operational decision-making. Typically Offered: Spring (Odd Years) and Varies.
Prereqs: Graduate standing in engineering or instructor's permission

ISE 5314 Simulation and Analysis of Systems (3 credits)
Analysis and design of production and service systems via simulation. Topics include model development based on performance requirements following formal methods, statistical design and analysis of simulation experiments, variance reduction, random variate generation, and Monte Carlo simulation. Typically Offered: Fall (Even Years) and Varies.
Prereqs: Graduate standing in engineering or instructor's permission

ISE 5322 Experimental Design and Analysis of Industrial Processes (3 credits)
Joint-listed with ISE 4322
Analyze and improve operational systems through the application of statistical inference methods and basic empirical model development. Hypothesis testing, confidence intervals, tolerance interval, bootstrap confidence intervals, and basic linear regression are applied to industrial engineering applications. Design and analysis of observational and factorial experiments employing numerical and graphical methods. Introduction to machine learning and big data methods. Additional work required for graduate students. Typically Offered: Spring and Varies.

ISE 5332 Human Factors and Ergonomics (3 credits)
Analysis and design of work systems considering human characteristics, capabilities and limitations. Analysis and design of displays, controls, tools, and workstations. Human performance analysis. Functional anatomy and physiology of the musculoskeletal system and their applications in work design. Introduction to work physiology, kinesiology, and anthropometry and their applications. Typically Offered: Fall.
Prereqs: Graduate standing in engineering or instructor's permission

ISE 5363 Production, Distribution, and Inventory Planning and Control (3 credits)
Joint-listed with ISE 4363
Forecasting techniques, inventory analysis, master production scheduling, material and capacity requirements, planning and scheduling methods. Additional work required for graduate students. Typically Offered: Fall and Varies.

ISE 5365 Advanced Continuous Improvement Methods (3 credits)
Integration of Industrial and Systems Engineering methods and tools to assist the design, implementation, and evaluation of modern continuous improvement systems. Theory, methods, and techniques of industrial and systems engineering are integrated with operational excellence methodologies to improve the performance of production, manufacturing, service, and delivery systems. Typically Offered: Spring (Even Years) and Varies.
Prereqs: Graduate standing in engineering or instructor's permission

ISE 5371 Engineering Project Management (3 credits)
Joint-listed with ISE 4371
Critical issues in the management of engineering and high-technology projects are discussed. Time, cost, and performance parameters are analyzed from the organizational, people, and resource perspectives. Network optimization and simulation concepts are introduced. Resource-constrained project scheduling case discussions and a term project are included. Additional work required for graduate students. Typically Offered: Fall and Varies.

ISE 5374 Advanced Engineering Economic Analysis (3 credits)
Cross-listed with EM 5374, TM 5374
Examine the economic dimension of engineering management and develop the ability to manage technical and non-technical issues related to the economics of organizations. Topics include major concepts and techniques in advanced economic analysis of engineering and organization management issues, and involve both qualitative and quantitative analysis. Typically Offered: Spring.
Prereqs: Graduate standing in engineering or instructor's permission

ISE 5381 Approaches to Managing Complex Systems (3 credits)
Joint-listed with ISE 4381
Improvement of organizational performance through the use and application of management systems engineering principles. Design and implementation of performance measurement systems that integrate personnel, technological, environmental, and organizational variables. Topics include performance assessment and measurement, systems approaches to managing complexity, and organizational design principles. Additional work required for graduate students. Typically Offered: Fall and Varies.

ISE 5382 Systems Science and Its Applications to Resolving Complex Problems (3 credits)
A survey of recent key systems philosophy and systems theory concepts and their applications to understanding and resolving complex problems, including theory of knowledge, general systems theory, systems principles, complexity and elegance, and conceptual modeling of systems using category theory. Typically Offered: Fall.
Prereqs: Graduate standing or instructor's permission

ISE 5383 Enterprise and Systems Architecting (3 credits)
Principles, standards, and practices of enterprise and systems architecting for complex organizations. Emphasis is placed on structures to leverage individual competencies to achieve organizational, system, and operational capabilities. Typically Offered: Fall (Even Years) and Varies.
Prereqs: Graduate standing in engineering or instructor's permission

ISE 5384 Fundamentals of Model-Based Systems Engineering Approaches (3 credits)
Design, implementation, and evaluation of modern operational excellence methodologies such as lean manufacturing and six sigma. Theory, methods, and techniques of operational excellence methodologies applied to production, manufacturing, service, and delivery systems. Examine the impact of operational excellence implementations in industrial processes, equipment, technology, and decision support systems. Typically Offered: Spring (Odd Years).
Prereqs: Graduate standing in engineering or instructor's permission

ISE 5990 (s) Non-thesis Master's Research (1-16 credits, max 99)
Credit arranged. Research not directly related to a thesis or dissertation.
Prereqs: Permission