

# INDUSTRIAL AND SYSTEMS ENGINEERING

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<https://ien.coe.miami.edu/index.html>

Dept. Code: ISE

## Overview

Industrial and Systems Engineering combines science and technical knowledge with human sciences to design, plan, and analyze systems that involve people, materials, money, energy, equipment, and other resources. Industrial engineers work with personnel in research and development, accounting, engineers in other disciplines, maintenance, human resources, and production to increase organizational productivity, improve quality, reduce health care costs, conserve energy, develop public transportation systems, and improve industrial safety conditions. Industrial and Systems engineering distinguishes itself from other engineering professions because it has applications in manufacturing, service, commercial, and governmental activities. It is the major branch of engineering concerned not only with technology, but with people, making industrial engineers a prime source of management talent.

Through consultation with his/her academic advisor, a student is assisted in choosing electives which will prepare him/her for a degree of specialization compatible with his/her future goals. The available concentrations are Engineering Management and Manufacturing. Specific courses required in each concentration are described in Degree Programs Section.

The Department of Industrial and Systems Engineering offers graduate programs leading to the:

- Master of Science in Industrial Engineering
- Master of Science in Environmental Health and Safety
- Master of Science in Management of Technology (in conjunction with the School of Business)

The Department also offers:

- a Ph.D. in Industrial Engineering.

For further information, see the Bulletin of the Graduate School (<http://bulletin.miami.edu/graduate-academic-programs/engineering/industrial-engineering/>).

## Bachelor of Science in Industrial Engineering

The curriculum includes required courses in mathematics and the physical sciences that ensure a firm scientific background while advanced departmental courses provide specialization. Required courses in the people and society - humanities and arts give students the social, ethical and ecological awareness needed in their profession. The courses are designed with the prerequisite structure in mind so that students have to draw from previously acquired knowledge to successfully complete upper level course requirements.

The engineering design experience is interwoven in the curriculum throughout the students' four years of study.

- Starting with EGN 114 Global Challenges Addressed by Engineering and Technology and EGN 123 Computing and Digital Solutions for the future students are given a broad introduction to Engineering. In addition they are introduced to a wide variety of topics in the digital realm including Python, Engineering graphics, Auto CAD, Excel, Tableau, Solid Works and AI applications.
- The students then move on to take ISE 201 Work Design Systems where they perform work measurement projects in industry and determine the impact of productivity. This is applied in a semester project in industry which includes writing a reports and making oral presentations to management..
- In the Spring of their Junior year, the students take ISE 363 Project Management for Engineers and they are exposed to techniques and tools in project management such as use of network flow and MS Project.
- Students take ISE 380 Engineering Economic Analysis where they become aware of the impact of productivity on the economic and social well-being of industry and countries. The students are also introduced to basic models of decision making such as the formulation and evaluation of an economic strategy.
- ISE 406 Computer-Aided Manufacturing introduces the students to product design in manufacturing and modern concepts of CAD/CAM/ Automation.
- ISE 441 Operations Research and Optimization Methods focuses on the formulation of linear programming problems and solutions by the simplex method. Related topics include sensitivity analysis, duality theory and network programming. Engineering applications are emphasized.
- ISE 442 Stochastic Modeling and Decision Making focuses on basic concepts and techniques of random processes that are used to develop models for a variety of engineering and managerial problems. Topics include the Poisson Process, Markov chains, renewal theory, queuing models, and reliability.
- ISE 465 Inventory and Supply Chain Management provides a thorough treatment of modern production and inventory management policies, and their ramifications on supply chain management. ISE 568 Facilities Planning and Logistics focuses on the analysis and design of production and service facilities, warehousing, and logistics.

- ISE 224 Python for Engineers will introduce programming and coding as a tool for analysis of industry systems. Theory and applications of decision support systems in industrial engineering are covered in ISE 524 Systems Intelligence with Software Applications. The topics include the study of model-based data-based, knowledge-based, and communication-based decision support systems.
- In ISE 557 Ergonomics and Human Factors Engineering both laboratory projects and real-world projects are designed, discussed, and conducted.
- Industry based projects are embedded into several other courses such as ISE 512 Quality Management Systems and ISE 547 Simulation Modeling and Systems Analysis.
- **ISE 494 Senior Design Project** is a capstone project course where the students pool all of their knowledge and previous design experience into one major project integrating all components of the curriculum together. These projects are usually industry-based. Students prepare written and oral presentations. These presentations are made before top management or engineers of the organization where the projects were conducted in the presence of the faculty representatives from the department.

Real world projects are an integral part of most junior and senior level courses. In these courses, communication is emphasized through requirements for oral presentation and written technical reports. This experience provides the graduates with valuable industrial experience and communications skills while studying at the University of Miami.

The teaching laboratories meet current program needs and are constantly being improved. Equipment and experiments are geared to provide instruction in the areas of production system design, work methods and measurement, human factors engineering, manufacturing processes, computer applications in industrial engineering and operations research.

**Advanced Writing and Communication Skills:** Industrial and Systems Engineering students satisfy the University's Advanced Writing and Communication Skills requirement by completing a set of classroom courses, laboratory courses and design courses where they learn effective oral, graphical and technical writing skills. Industrial Engineering students acquire Advanced Writing and Communication skills in the following core courses:

- ISE 201 Work Design Systems
- ISE 351 Safety and Ethics in Engineering
- ISE 363 Project Management for Engineers
- ISE 380 Engineering Economic Analysis
- ISE 494 Senior Design Project
- ISE 512 Quality Management Systems
- ISE 547 Simulation Modeling and Systems Analysis
- ISE 557 Ergonomics and Human Factors Engineering
- ISE 568 Facilities Planning and Logistics

#### Industrial Engineering Concentrations

- Engineering Management Concentration
- Manufacturing Engineering Concentration
- Pre-Medical Concentration

## Five-Year Bachelor of Science in Industrial Engineering and Master of Science in Industrial Engineering (Five-Year BSIE/MSIE Program)

This program is specifically designed for those students who want to pursue their graduate study as soon as they complete their undergraduate study in Industrial Engineering. The special conditions for this Five-Year BSIE/MSIE Program are as follows:

1. The student must declare his/her intent to participate before the end of the Junior year by submitting an official application to the department graduate committee for admission into the MSIE portion of the program. Exceptions to this rule must be approved by the department faculty.
2. A student wishing to withdraw from the Five-Year Program without the MSIE degree must complete all the requirements for the BSIE program, including the IEN 494 Senior Project in order to get his/her BSIE degree.
3. To qualify for the MSIE degree, the student must meet all the pertinent Graduate School requirements, including an acceptable score on the GRE (Graduate Record Examination) and a minimum of 3.0 GPA.
4. The student is awarded both the BSIE and MSIE degrees at the end of the fifth year when all undergraduate and graduate requirements are satisfied.

## Dual B.S./M.S. Degrees in Industrial and Systems Engineering

- B.S./M.S. in Industrial Engineering - Five Year Dual Degree (<http://bulletin.miami.edu/undergraduate-academic-programs/engineering/industrial-engineering/five-year-bachelor-science-industrial-engineering-master-science-industrial-engineering-bsie-msie/>)
- B.S. in Industrial Engineering/M.S. in Mechanical Engineering (<http://bulletin.miami.edu/undergraduate-academic-programs/engineering/industrial-engineering/industrial-engineering-bs-mechanical-engineering-ms/>)

- B.S in Industrial Engineering/M.S. in Software Engineering (<http://bulletin.miami.edu/undergraduate-academic-programs/engineering/industrial-engineering/bs-industrial-engineering-ms-software-engineering/>)

**ISE 102. Introduction to Project Management and Work Design Systems. 3 Credit Hours.**

This introductory course is designed to expose high school students to Industrial and Systems engineering. The course will introduce Project Management and it will be woven throughout the 3-week course culminating in a final project presentation. All students enrolled in this course will gain experience in problem solving, engineering design, computer applications, and hands-on activities. The course content includes topics on work design, methods analysis, time studies, human factors engineering, and project management. The students will be provided with an understanding and some hands-on experience on topics relative to the discipline of industrial and systems engineering. The laboratory and field trip experiences will enhance the classroom experience and provide an insight to the depth and breadth of the discipline. Summer Scholar Students only.

Requisite: Summer Scholars/ UM Academy only.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Summer.

**ISE 201. Work Design Systems. 3 Credit Hours.**

This course will show the design of improved methods for doing work based on effective human effort. Time standardization of productive operations by work measurement, predetermined time systems, and activity sampling are discussed. Labor estimation techniques will be discussed. Tools and charts for methods analysis are discussed and the use of Microsoft Visio and Microsoft Excel is emphasized and reviewed.

Prerequisite: EGN 123 or ISE 112.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall & Spring.

**ISE 224. Python for Engineers. 3 Credit Hours.**

Programming plays an important role in engineering. This course aims to establish the foundations for basic programming with focus on python. It comprehensively discusses the fundamental topics in programming, such as Data types, Variables, Iterators, Control flows, Functions, Modules, Class, Objects, and Object-Oriented Design.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**ISE 280. Fundamentals of Financial Engineering. 3 Credit Hours.**

Course Description: This course introduces the basic principles of financial engineering to students in the College of Engineering. It concentrates on the description of different financial products. Basic mathematical and engineering principles are applied to the study of financial instruments. Financial tools are explained in a practical manner. The course focuses on how financial tools are created and how the tools work together to achieve specific goals. Applications are illustrated using real-world examples. Main financial products covered are Equities, Bonds, and Currencies. Cash flows covered include spot, options, and forwards and futures. Credit products covered are collateralized debt obligations, special purpose vehicles, and credit default swaps. Portfolio creation, portfolio construction, and strategy development are studied. The course gives a primer on analyzing financial statements (balance sheet, income statement, and cash flow statement), bonds, corporate valuations, stock trading fundamentals (fundamental analysis, technical analysis, algorithmic trading), mergers and acquisitions (tender offers, hostile takeovers, leveraged buyouts), stock repurchases, options valuation, futures, commodities, mutual and index funds, hedge funds, currency exchange, risk analysis, real estate investing, and portfolio balancing and optimization.

Requisite: Sophomore Standing.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**ISE 310. Introduction to Engineering Probability. 3 Credit Hours.**

Axioms of probability, discrete and continuous random variables, probability density functions, cumulative distribution function, expectation, conditioning, independence, functions of random variables, multiple random variables, sums of random variables, introduction to statistical analysis, estimation, and hypothesis testing. Cross-listed with EEN 310.

Prerequisite: MTH 162 or MTH 172 and Requisite: Junior Standing.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall & Spring.

**ISE 311. Applied Probability and Statistics. 3 Credit Hours.**

This course covers fundamental probability concepts, random variables, mathematical expectation, discrete and continuous probability distributions, sampling distributions, point and interval estimation, hypothesis testing, and simple linear regression and correlation. The use of Minitab, a statistical software application, is emphasized. Examples are drawn from various disciplines.

Prerequisite: MTH 162 or MTH 172.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall & Spring.

**ISE 312. Foundations of Data Analysis. 3 Credit Hours.**

This course aims to establish a solid background for data analysis. It covers fundamental topics, such as Data Properties, Estimation, Hypothesis and Testing, Regression and Classification, Design of Experiments, and Clustering, to establish the foundations of data analysis. This course not only builds up the theoretical knowledge but also relies on useful computer software (e.g., EXCEL, Minitab, and R) to enable the capability to handle large-scale problems.

Prerequisite: ISE 310 or ECE 310 or ISE 311 or MAS 311 or equivalent.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**ISE 351. Safety and Ethics in Engineering. 3 Credit Hours.**

This course will address basic principles of accident prevention and safety engineering approaches to the design of facilities, manufacturing processes and organizational systems. Ethical decision making and analysis will be explored as a function of designing organizational safety plans. It also includes the analysis and design of safety procedures and accident control procedures in industry.

Requisite: Junior Status or Permission of Instructor.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**ISE 363. Project Management for Engineers. 3 Credit Hours.**

This course guides students through fundamental project management concepts and behavioral skills needed to successfully launch, lead, and realize benefits from projects in profit and nonprofit organizations. In this course, students explore project management with a practical, hands-on approach through case studies and class exercises. In addition, you will participate in a project as a project manager and as a resource.

Requisite: Junior Status or Permission of Instructor.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**ISE 372. Emerging Technologies and the Creation of Technological Innovations. 3 Credit Hours.**

A variety of emerging technologies will be discussed (nanotechnology, energy technologies, information technologies, biotechnologies, etc). The process of utilization in innovations will be covered.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**ISE 380. Engineering Economic Analysis. 3 Credit Hours.**

This course will explore engineering economy fundamentals. Interest and money-time relationship, methods of making economic decisions, risk and uncertainty, and sensitivity analysis. In addition, analysis will include selections among multiple alternatives, depreciation, after tax analysis, benefit-cost analysis, replacement studies, cost analysis techniques.

Prerequisite: MTH 162 or MTH 172.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**ISE 399. Internship. 1-3 Credit Hours.**

Practical application of classroom theory through employment with firms offering positions consistent with the student's field of study. Course may be repeated.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall, Spring, & Summer.

**ISE 406. Computer-Aided Manufacturing. 3 Credit Hours.**

A comprehensive view of manufacturing with a focus on design, automation, and the use of computers in manufacturing. The topics include computer-aided design, communications, programmable logic controllers, CNC machining, industrial robots, process planning, and computer-integrated manufacturing. Laboratory projects are an integral part of the course.

Prerequisite: CHM 121 or CHM 151 and PHY 221.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**ISE 407. Product Design for Manufacturing. 3 Credit Hours.**

The different phases of engineering design process. Guided Iteration Methodology for product design. Topics include design for manufacturing (DFM), best practices of product realization, solid modeling using SolidWorks, quality in design, issues in patents, liability and ethics. Engineering design specifications, evaluation methods for design alternatives.

Prerequisite: ISE 406.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Offered by Announcement Only.

**ISE 441. Operations Research and Optimization Methods. 3 Credit Hours.**

Introduction to principles and techniques used for optimal decision-making through mathematical modeling and analysis. Main topics include mathematical modeling/programming, linear programming, integer programming, network optimization, and dynamic programming. The application focus of the course will be on engineering and business problems.

Prerequisite: MTH 210.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall & Spring.

**ISE 442. Stochastic Modeling and Decision Making. 3 Credit Hours.**

This course introduces fundamental probability models and decision-making tools for systems subject to uncertainty. Course topics include a brief review of probability concepts, Markov chains, Poisson processes and queueing theory, decision analysis, and dynamic programming. Applications will be drawn from queueing systems, reliability and quality engineering, inventory management, transportation and assignment problems, and finance. Some software may be used (e.g., Excel and MATLAB) to illustrate concepts.

Prerequisites: ISE 310 or ECE 310 or ISE 311 or MAS 311 and ISE 441.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall & Spring.

**ISE 465. Inventory and Supply Chain Management. 3 Credit Hours.**

This course consists of production and inventory management techniques such as forecasting methods, inventory control subject to both known and uncertain demand, aggregate planning, introduction to scheduling, materials requirement planning (MRP), and an introduction to quantitative modeling of supply chain management systems.

Prerequisite: ISE 310 or ECE 310 or ISE 311 or MAS 311 or equivalent.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**ISE 494. Senior Design Project. 3 Credit Hours.**

This course includes the integration of Industrial and Systems Engineering principles and techniques in the design and improvement of production and service systems. Included in the course is a culminating design experience with the preparation of a project proposal, data collection, analysis, comprehensive final report, and formal presentations to stakeholders.

Prerequisite: ISE 547. And Requisite: Senior Standing.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall & Spring.

**ISE 501. Manufacturing Analysis and Design I. 3 Credit Hours.**

Analysis of Production Systems stressing diagnosis of problems associated with work measurement, manufacturing methodologies, and their interaction with cost factors.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Offered by Announcement Only.

**ISE 502. Manufacturing Analysis and Design II. 3 Credit Hours.**

Analysis of production systems stressing diagnosis of problems of quality and production control, utilizing quantitative techniques and analytical methods.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Offered by Announcement Only.

**ISE 505. Robotics. 3 Credit Hours.**

Fundamentals of robotics including kinematics and dynamics, trajectory planning, sensors and actuators, robotic vision, and case studies. Building your own robot is an integral part of hands-on laboratory exercises. Matlab controltoolbox and image analysis toolbox will be extensively used for design and analysis.

Prerequisite: ISE 406.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring Even Years.

**ISE 507. Design of Manufacturing Systems. 3 Credit Hours.**

State-of-the-art techniques and tools relevant to the design, analysis, and control of modern manufacturing systems. Topics include modeling of manufacturing systems, tools for manufacturing system analysis, manufacturing system planning and scheduling, and lean manufacturing systems.

Prerequisite: ISE 465.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring Odd Years.

**ISE 509. Automated Assembly. 3 Credit Hours.**

Fundamentals of automated assembly including parts transfer systems and feeders, parts orientation and grasping techniques, product design for automated assembly (DFA), assembly robots, and performance and economics of assembly systems.

Prerequisite: ISE 406.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Offered by Announcement Only.

**ISE 512. Quality Management Systems. 3 Credit Hours.**

This course addresses the concepts, theories, tools and methodologies employed in the management and improvement of quality. The course examines many of the advance topics in statistical quality control including control charts, process capability studies, acceptance sampling and Quality Function Deployment (QFD). Also covered in the course are Lean Six Sigma methodology, tools and concepts.

Prerequisite: ISE 311 or MAS 311 or ISE 312 or MAS 312 or equivalent.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**ISE 513. Quality Management in Service Organizations. 3 Credit Hours.**

Course examines the issues of quality and productivity management in the service sector. Topics covered include the development and use of questionnaires, service industry applications of quality such as in banking, insurance, healthcare, transportation, government, public utilities, and retail trade.

Requisite: Senior Standing.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**ISE 516. Introduction to Applied Data Analytics. 3 Credit Hours.**

This course focuses on some of the most commonly-used data analytics models and covers the basics of data analytics using the open source software R (which is one of the fastest growing open source software platforms). Specific course topics include Data Preprocessing and Cleaning, Fundamentals of R (for basic data analytics tasks), Regression Analysis, Discriminant Analysis & Classification, Segmentation/Clustering, Model Tuning/Selection, Performance Measurement in Data Analytics, and Decision Making with Data. This course provides hands-on skills to engineering graduate students with performing statistical data analysis and decision-making utilizing common types of data sets.

Prerequisite: ISE 442 And ISE 312.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**ISE 517. Reinforcement Learning and Decision Making Under Uncertainty. 3 Credit Hours.**

This selective course gives a firm foundation to reinforcement learning (RL) and decision theory from mainly a statistical perspective. We start with a discussion of utility theory to learn how preferences can be represented and modeled for decision making. We first model simple decision problems as multi-armed bandit problems and discuss several approaches to evaluate feedback. We will then model decision problems as Markov decision processes (MDPs), and discuss their solutions via dynamic programming and filtering algorithms. Finally, we introduce different types of reinforcement learning algorithms and discuss their applications in financial management, health-care, next generation networks, system operation and environmental engineering. We conclude the course with a discussion of advanced RL solutions, such as meta learning, inverse RL, multi-agent RL, and other open topics in RL, with the goal of introducing the RL generalization that can adapt and apply to various real-world scenarios. An emphasis on algorithms and applications will be a key part of this course.

Pre-requisite: ISE 224 or CSC 115 and ISE 442.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**ISE 524. Systems Intelligence with Software Applications. 3 Credit Hours.**

Theory and application of designing decision support systems using Microsoft Excel VBA. Topics include studying of advanced excel techniques, designing efficient graphical user interfaces using Visual Basic for Applications. Optimizing the development process workflow. Accessing data sources provided by different database engines. Optimizing the final code.

Requisite: Senior Standing.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**ISE 547. Simulation Modeling and Systems Analysis. 3 Credit Hours.**

The objective of this course is to develop student's ability to model real systems and carry out effective and successful analysis of these systems using discrete event simulation. In this course, students will learn the basic concepts and algorithms of modeling and analysis. Students will get familiar with (1) formulating an appropriate simulation model for a system, (2) implementing the model as a computer program, and (3) evaluating the output of the model. Theoretical topics include random variable generation, model verification and validation, statistical input and output analysis

Prerequisites: ISE 442.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall & Spring.

**ISE 548. Games and Decision Making. 3 Credit Hours.**

This course covers fundamentals of decision theory and game theory. The course is research oriented and a significant part of the grading will be based on students' research. Topics include optimization with multiple variables, constrained optimization, Lagrange relaxation, utility theory, decision making under uncertainty, simultaneous move (Nash) games, sequential decision making, sequential (Stackelberg) games, games with imperfect information, contracting and coordination, and bargaining. This course is composed of lectures, in-class discussions and problem solving, homework assignments, and research paper assignments.

Prerequisite: ISE 310. And ISE 441.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Offered by Announcement Only.

**ISE 554. Applied Computational Biomechanics. 3 Credit Hours.**

Students will become familiarized with current tools in the field of computational biomechanics for applications in ergonomics, sports performance, simulations of occupational activities and human movement in general. Through the presentation of case studies and the completion of assignments, students will gain hands-on experience on full-body simulation environments (e.g., OpenSim), biomechanically oriented finite elements packages (e.g., FEBio), and software for reconstruction of human anatomy from medical images (Seg3D).

Prerequisite: ISE 557. Or BME 375.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Offered by Announcement Only.

**ISE 557. Ergonomics and Human Factors Engineering. 3 Credit Hours.**

The study of human capacities and limitations with emphasis on human performance in system design. Topics include design of displays and controls, workload, job design, human information processing, anthropometry, workplace design, biomechanics, task analysis, and research techniques in human factors engineering. Lecture, 3 hours.

Prerequisite: ISE 312 or MAS 312.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall & Spring.



**ISE 568. Facilities Planning and Logistics. 3 Credit Hours.**

This course focuses on the analysis and design of production and service facilities, including materials handling, facilities layout, warehouse and distribution systems, as well as logistics and supply chain.

Requisite: Senior Standing.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**ISE 570. Engineering Management. 3 Credit Hours.**

This course teaches the numerical techniques of management science for engineering problems. It covers a variety of solutions to practical problems using Microsoft Excel, Matlab and other solvers. This is a hands-on course utilizing practical examples that require the use of a number of methods but focuses not only on finding the optimal solution but analyzing the result in a manner that allows us to understand the sensitivity of the solution to different parameters. The course also includes the use of financial ratios and analysis.

Prerequisite: ISE 311 or MAS 311 or ISE 312 or MAS 312.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**ISE 571. Engineering Entrepreneurship. 3 Credit Hours.**

This course teaches an integrated strategy framework for entrepreneurs. The course will explore various strategies and how to position a startup group against competition in an advantageous manner. In addition, you will learn tools for analyzing ongoing ventures to improve the competitive edge. The final project will emphasize the structured approach to strategy selection and evaluating alternatives.

Requisite: Senior Standing.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**ISE 572. Management of Technological Innovation. 3 Credit Hours.**

Engineering, Science and Management Principles contributing to the development of a successful framework for Managing technology with an organization, nationally or internationally. The process of technological innovations, technological planning and forecasting, and socio-economic changes. Prerequisite: Senior or graduate standing.

Requisite: Senior Standing.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**ISE 580. Principles of Financial Engineering I. 3 Credit Hours.**

Course Description: This course introduces the basic principles of financial engineering to students in the College of Engineering. It concentrates on the engineering methods of financial engineering. Methods, models, and analysis learned by students in subjects like stochastic models, simulation, optimization, probability, and statistics, are applied to the study of financial instruments. Financial tools are explained in a practical manner. The course focuses on how to create financial tools and how the tools work together to achieve specific goals. Applications are illustrated using real-world examples. Main financial products covered are Equities, Bonds, and Currencies. Cash flows covered include spot, options, and forwards and futures. Credit products covered are collateralized debt obligations, special purpose vehicles, and credit default swaps. Portfolio creation, portfolio construction, and strategy development are studied. The course gives a primer on analyzing financial statements (balance sheet, income statement, and cash flow statement), bonds, corporate valuations, stock trading fundamentals (fundamental analysis, technical analysis, algorithmic trading), mergers and acquisitions (tender offers, hostile takeovers, leveraged buyouts), stock repurchases, options valuation, futures, commodities, mutual and index funds, hedge funds, currency exchange, risk analysis, real estate investing, and portfolio balancing and optimization.

ISE 380.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.



**ISE 581. Principles of Financial Engineering II. 3 Credit Hours.**

This course introduces the basic principles of financial engineering to students in the College of Engineering. It concentrates on the engineering methods of financial engineering. Methods, models, and analysis learned by students in subjects like stochastic models, simulation, optimization, probability, and statistics, are applied to the study of financial instruments. Financial tools are explained in a practical manner. The course focuses on how to create financial tools and how the tools work together to achieve specific goals. Applications are illustrated using real-world examples. Main financial products covered are Equities, Bonds, and Currencies. Cash flows covered include spot, options, and forwards and futures. Credit products covered are collateralized debt obligations, special purpose vehicles, and credit default swaps. Portfolio creation, portfolio construction, and strategy development are studied. The course gives a primer on analyzing financial statements (balance sheet, income statement, and cash flow statement), bonds, corporate valuations, stock trading fundamentals (fundamental analysis, technical analysis, algorithmic trading), mergers and acquisitions (tender offers, hostile takeovers, leveraged buyouts), stock repurchases, options valuation, futures, commodities, mutual and index funds, hedge funds, currency exchange, risk analysis, real estate investing, and portfolio balancing and optimization.

ISE 580.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**ISE 590. Special Topics in Industrial Engineering. 1-3 Credit Hours.**

Sub-titles describing the topics are shown in parentheses in the class schedule, following the title "Special Topics".

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall, Spring, & Summer.

**ISE 595. Special Problems. 1-3 Credit Hours.**

Project course introducing methods of research through an individual investigation of current problems. Offered by special arrangement only.

**Components:** THI.

**Grading:** GRD.

**Typically Offered:** Fall, Spring, & Summer.

**ISE 596. Special Problems. 1-3 Credit Hours.**

Project course introducing methods of research through an individual investigation of current problems. Offered by special arrangement only.

**Components:** THI.

**Grading:** GRD.

**Typically Offered:** Offered by Announcement Only.

**ISE 599. Cooperative Education. 1 Credit Hour.**

Practical application of classroom theory through alternating semester or summer employment with industries offering positions consistent with the student's field of study. Course may be repeated. Periodic reports and conferences are required.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Offered by Announcement Only.