Industrial Engineering (INEG)

Courses

INEG 2001. Industrial Engineering Seminar. 1 Hour.
Overview of the Department of Industrial Engineering: faculty and their backgrounds and interests, staff and the services they provide, facilities, curricular requirements, extracurricular opportunities, post-graduate opportunities. (Typically offered: Fall)

INEG 2103. Introduction to Industrial Engineering. 3 Hours.
Introduction to the technical content of industrial engineering and the use of computing in the solution of traditional industrial engineering problems. Computer tools include spreadsheets, programming, and mathematical analysis software. Corequisite: Lab component. (Typically offered: Fall)

INEG 2313. Applied Probability and Statistics for Engineers I. 3 Hours.
Applications to engineering problems of probability theory, discrete and continuous random variables, descriptive statistics, single-population point and interval estimation, single-population hypothesis testing, goodness-of-fit testing, and contingency table testing. Corequisite: Drill component. Prerequisite: MATH 2564. (Typically offered: Fall and Spring)

INEG 2313H. Honors Applied Probability and Statistics for Engineers I. 3 Hours.
Applications to engineering problems of probability theory, discrete and continuous random variables, descriptive statistics, single-population point and interval estimation, single-population hypothesis testing, goodness-of-fit testing, and contingency table testing. Corequisite: Drill component. Prerequisite: MATH 2564. (Typically offered: Fall and Spring)

This course is equivalent to INEG 2313.

INEG 2333. Applied Probability and Statistics for Engineers II. 3 Hours.
Applications to engineering problems of two-population point and interval estimation, two-population hypothesis testing, linear regression, correlation, design of experiments, analysis of variance, and nonparametric statistics. Introduction to statistical quality control. Corequisite: Drill component. Prerequisite: INEG 2313. (Typically offered: Fall and Spring)

INEG 2403. Industrial Cost Analysis. 3 Hours.
Use of accounting information for planning and control with emphasis on the engineering viewpoint; introduction to general accounting procedures; principles of cost accounting and other aspects of production costs; budgeting, depreciation, taxes, distribution of profits, securities, sources of corporate capital, interpretation of financial statements, and other related topics. Laboratory required. Corequisite: Lab component. (Typically offered: Fall and Spring)

INEG 2413. Engineering Economic Analysis. 3 Hours.
Economic aspects of engineering, including current economic problems and the treatment of estimates when evaluating alternative courses of action. Methods of selection and replacement of equipment and break-even points of operation; desirability of new processes or projects where asset life, rate of return on investment, and first, fixed, differential, marginal, and sunk costs must be considered. Corequisite: Drill component. Prerequisite: MATH 2554. (Typically offered: Fall and Spring)

INEG 2812H. Honors Industrial Engineering Research Experience I. 2 Hours.
Introduction to the research of the faculty of the Department of Industrial Engineering for the purpose of matching students with an undergraduate research advisor. Development of skills in using electronic resources to conduct background research on individuals and topics in the industrial engineering academic community. Prerequisite: Instructor consent and honors standing. (Typically offered: Spring)

INEG 3513. Manufacturing Processes. 3 Hours.
This course focuses on the manufacturing processes that impart geometry and properties to engineering materials including casting, metalworking, machining, joining, heat treatment, and polymer processes. Process selection and analysis, design-for-manufacturing principles, cost estimation, and selection of process parameters are covered. Lab component covers communication of manufacturing specifications via engineering drawings. Prerequisite: MEEG 2303. Corequisite: Lab component. (Typically offered: Spring)

INEG 3613. Introduction to Operations Research. 3 Hours.
Introduction to modeling and analysis of deterministic operations design and planning problems using formal optimization algorithms and software. Identification and formulation of appropriate applications, linear programming, sensitivity, network flows/transportation/assignment problems, shortest paths, and integer linear programming. Prerequisite: INEG 2103 and MATH 2574. (Typically offered: Spring)

INEG 3623. Simulation. 3 Hours.
The development and use of discrete-event simulation models for the analysis and design of systems found in manufacturing, distribution, and service contexts. Coverage includes conceptual modeling, model translation to computer form, statistical input models, random number generation and Monte Carlo methods, experimentation and statistical output analysis, and queueing analysis. Includes the use of modern computer simulation languages. Prerequisite: INEG 2413 and CSCE 2004. Pre- or Corequisite: INEG 2333. (Typically offered: Fall)

INEG 3623H. Honors Simulation. 3 Hours.
The development and use of discrete-event simulation models for the analysis and design of systems found in manufacturing, distribution, and service contexts. Coverage includes conceptual modeling, model translation to computer form, statistical input models, random number generation and Monte Carlo methods, experimentation and statistical output analysis, and queueing analysis. Includes the use of modern computer simulation languages. Corequisite: INEG 2333 and drill component. Prerequisite: INEG 2413 and CSCE 2004. (Typically offered: Fall)

This course is equivalent to INEG 3623.

INEG 3714. Work Methods and Ergonomics. 4 Hours.
Ways of designing jobs, machines, operations and work environments so they are compatible with human capacities and limitations. Work methods topics include methods analysis, time studies, work sampling and learning curves. Cognitive and physical capabilities and limitations of humans are addressed through the study of human information processing, motor control theory, anthropometry, biomechanics, work physiology and manual material handling. Design of controls and displays, hand tools and workstations, along with work related musculoskeletal disorders. Laboratory required. Corequisite: Lab component. Pre- or Corequisite: INEG 2333. (Typically offered: Fall and Spring)

INEG 3812H. Honors Industrial Engineering Research Experience II. 2 Hours.
Development of an undergraduate research proposal. Introduction to the peer review process. Examination of conference travel, nationally-competitive award, and graduate fellowships. Emphasis on technical communication skills. Prerequisite: INEG 2812H and honors standing. (Typically offered: Fall)

INEG 400VH. Honors Thesis. 1-3 Hour.
For Honors College students majoring in Industrial Engineering only. Prerequisite: Honors college students only and instructor consent. (Typically offered: Fall, Spring and Summer)

INEG 410V. Special Topics in Industrial Engineering. 1-3 Hour.
Consideration of current industrial engineering topics not covered in other courses. Prerequisite: Senior standing. (Typically offered: Irregular) May be repeated for up to 3 hours of degree credit.
INEG 410VH. Honors Special Topics in Industrial Engineering. 1-3 Hour.
Consideration of current industrial engineering topics not covered in other courses. Prerequisite: Senior standing. (Typically offered: Irregular) May be repeated for up to 3 hours of degree credit. This course is equivalent to INEG 410V.

INEG 411V. Individual Study in Industrial Engineering. 1-3 Hour.
Individual study and research on a topic mutually agreeable to the student and a faculty member. Prerequisite: Instructor consent. (Typically offered: Fall, Spring and Summer)

INEG 411VH. Honors Individual Study in Industrial Engineering. 1-3 Hour.
Individual study and research on a topic mutually agreeable to the student and a faculty member. Prerequisite: Instructor consent and honors candidacy. (Typically offered: Fall, Spring and Summer) This course is equivalent to INEG 411V.

INEG 4123. Global Engineering and Innovation. 3 Hours.
This course provides engineering students a global perspective for design and innovation. Students explore various design thinking tools and techniques. Students apply engineering design and innovation techniques to create solutions that meet specified markets with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental and economic factors. Students also have the opportunity to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which considers the impact of the engineering solution in the global, economic, environmental, and social contexts. Prerequisite: Senior standing or instructor consent. (Typically offered: Irregular)

INEG 4163. Introduction to Modern Statistical Techniques for Industrial Applications. 3 Hours.
This application-oriented course is driven by real problems arising from industry and focuses on problem solving using both modern and classic statistical methods. For both senior undergraduate and graduate students, the main goal of this course is to provide a comprehensive introduction to those most popular statistical learning methods and tools (such as R and Apache Spark) which are widely used in industry today. Prerequisite: INEG 2333. (Typically offered: Spring)

INEG 4223. Occupational Safety and Health Standards. 3 Hours.
Survey of existing and proposed standards by examining fundamental physical, economic, and legal bases. Performance vs. specific standards. Enforceability and data collection. National consensus and promulgation process. Includes a computer-based design project. Prerequisite: INEG 2313. (Typically offered: Irregular)

INEG 4223H. Honors Occupational Safety and Health Standards. 3 Hours.
Survey of existing and proposed standards by examining fundamental physical, economic, and legal bases. Performance vs. specific standards. Enforceability and data collection. National consensus and promulgation process. Includes a computer-based design project. Prerequisite: INEG 2313. (Typically offered: Irregular) This course is equivalent to INEG 4223.

INEG 4253. Leadership Principles and Practices. 3 Hours.
The course is designed to expose students to multiple approaches to leadership in a wide variety of settings. Leadership styles, the knowledge areas and competencies expected of today's leaders, the challenges leaders face, the historical and philosophical foundations of leadership, the relationships among leadership theory, leadership practice, and the moral-ethical aspects of leadership are among the topics covered in the course. A number of respected regional, national, and international leaders share "lessons learned" in their leadership journeys. Plus, a number of highly regarded leadership books and case studies on leadership are read and discussed. Students may not receive credit for INEG 4253 and INEG 5253/OMGT 5253. Prerequisite: Senior standing. (Typically offered: Fall) This course is equivalent to INEG 4253H.

INEG 4253H. Honors Leadership Principles and Practices. 3 Hours.
The course is designed to expose students to multiple approaches to leadership in a wide variety of settings. Leadership styles, the knowledge areas and competencies expected of today's leaders, the challenges leaders face, the historical and philosophical foundations of leadership, the relationships among leadership theory, leadership practice, and the moral-ethical aspects of leadership are among the topics covered in the course. A number of respected regional, national, and international leaders share "lessons learned" in their leadership journeys. Plus, a number of highly regarded leadership books and case studies on leadership are read and discussed. Students may not receive credit for INEG 4253 and INEG 5253/OMGT 5253. Prerequisite: Honors standing and instructor consent. (Typically offered: Fall) This course is equivalent to INEG 4253.

INEG 4323. Quality Engineering and Management. 3 Hours.
Provides the student with complete coverage of the functional area of "Quality Assurance" ranging from the need for such a function, how it works, techniques utilized, and managerial approaches for insuring its effectiveness. Prerequisite: INEG 2333. (Typically offered: Irregular)

INEG 4343. Cognitive Ergonomics. 3 Hours.
Studies of human cognition in work settings in order to enhance performance of cognitive tasks through an understanding of cognitive processes (e.g., attention, perception errors, decision making, workload) required of operators in modern industries. Emphasis lies on how to (re)design human-machine interfaces and cognitive artifacts so that human well-being and system performance are optimized in work environments. Prerequisite: CSCE 2004 (Typically offered: Irregular)

INEG 4383. Risk Analysis for Transportation and Logistics Systems. 3 Hours.
Fundamentals of modeling risk, analyzing risk, and managing risk in a variety of industrial and government decision-making settings. Risk measurement and model building, uncertainty quantification, and multi-objective trade-offs. Prerequisite: INEG 2313 and INEG 4553. (Typically offered: Irregular)

INEG 4423. Advanced Engineering Economy. 3 Hours.
Preparation of feasibility studies, including cost estimation, risk and uncertainty, sensitivity analysis and decision making. Effects of taxes, depreciation and financing costs on cash flows. Prerequisite: INEG 2313 and INEG 2413. (Typically offered: Irregular)

INEG 4423H. Honors Advanced Engineering Economy. 3 Hours.
Preparation of feasibility studies, including cost estimation, risk and uncertainty, sensitivity analysis and decision making. Effects of taxes, depreciation and financing costs on cash flows. Prerequisite: INEG 2413. (Typically offered: Irregular) This course is equivalent to INEG 4423.

INEG 4433. Systems Engineering and Management. 3 Hours.
Overview of the fundamental concepts underlying the management of engineering. Reviews the engineering decision process within the life cycle. Examines implementation of basic management functions in technical organizations and development of strategy tools within a complex organization. Prerequisite: INEG 2403. (Typically offered: Fall)

INEG 4433H. Honors Systems Engineering and Management. 3 Hours.
Overview of the fundamental concepts underlying the management of engineering. Reviews the engineering decision process within the life cycle. Examines implementation of basic management functions in technical organizations and development of strategy tools within a complex organization. Prerequisite: INEG 2403 (Typically offered: Fall) This course is equivalent to INEG 4433.
INEG 4443. Project Management. 3 Hours.
Analysis of the strategic level of project management including planning, organizing, and staffing for successful project execution. Professional creativity, motivation, leadership, and ethics are also explored. At the tactical level, project selection, control, and systems management are analyzed. Systems development and decision support tools for project management are studied. Prerequisite: Senior standing. (Typically offered: Irregular)

INEG 4443H. Honors Project Management. 3 Hours.
Analysis of the strategic level of project management including planning, organizing, and staffing for successful project execution. Professional creativity, motivation, leadership, and ethics are also explored. At the tactical level, project selection, control, and systems management are analyzed. Systems development and decision support tools for project management are studied. Prerequisite: Senior standing. (Typically offered: Irregular)

This course is equivalent to INEG 4443.

INEG 4453. Productivity Improvement. 3 Hours.
Analysis of common productivity problems. Development of skills required to diagnose problems; measure productivity; develop improvement strategies; and provide for the implementation and maintenance of productivity measurement and improvement systems. Prerequisite: Senior standing. (Typically offered: Irregular)

INEG 4533. Application of Machine Vision. 3 Hours.
Automated machine vision applied to assembly and inspection tasks traditionally performed by human operators; development of application by acquiring image, processing image data, analyzing image and transmitting results; application analysis, selection and economics. Laboratory required. Corequisite: Lab component. Prerequisite: Senior standing. (Typically offered: Spring)

INEG 4543. Facility Logistics. 3 Hours.
The design and analysis of efficient logistics systems at the facility level, with an emphasis on distribution facilities. Unit load, break bulk, crossdock and order fulfillment centers and their component systems and software. Automated and manual systems. Corequisite: Lab component. Prerequisite: INEG 2413 and INEG 3613. (Typically offered: Irregular)

INEG 4553. Production Planning and Control. 3 Hours.
Strategy and competition, forecasting, aggregate planning, inventory control subject to known demand, inventory control subject to uncertain demand, supply chain management, push and pull production control systems, and operations scheduling. Pre or Corequisite: INEG 3613. Prerequisite: INEG 2333. (Typically offered: Fall)

INEG 4563. Industrial Robotics. 3 Hours.
An interdisciplinary treatment of: industrial robotics; manipulator anatomy, control, and programming; end-of-arm tooling; sensors & sensing; system integration and safety; future trends. Significant out-of-class programming assignments to solve common industrial automation problems. Corequisite: Lab component. Prerequisite: Senior standing. (Typically offered: Fall)

INEG 4593. Manufacturing Systems. 3 Hours.
This course is designed to highlight the major topics in manufacturing systems. Different manufacturing models and metrics are emphasized. This course also introduces classification, general terminology, technical aspects, economics, and analysis of manufacturing systems. Corequisite: Lab component. Prerequisite: INEG 3513 or graduate standing. (Typically offered: Irregular)

INEG 4633. Transportation Logistics. 3 Hours.
Quantitative aspects of transportation and logistics involving analysis and optimization. Topics include: facility location analysis, network design, network flow and transportation modeling, vehicle routing, fleet sizing, driver assignment, and supply chain issues (logistics demand, role of inventory in the network, role of technology, etc.). Prerequisite: INEG 2333 and INEG 3613. (Typically offered: Irregular)

INEG 4683. Decision Support in Industrial Engineering. 3 Hours.
Reinforcing important computer programming methods using industrial engineering-based applications. Students will utilize Microsoft Excel and Visual Basic for Applications to develop custom solutions to challenging industrial engineering problems. Emphasis on computational proficiency and computing productivity in a spreadsheet-based setting. Prerequisite: CSCE 2004 and INEG 2313. (Typically offered: Fall)

INEG 4733. Industrial Ergonomics. 3 Hours.
Gives background and experience in measurement and evaluation of human performance as it pertains to the working environment. The physical, physiological and psychological capabilities of the tasks they are to perform. Laboratory projects required. Prerequisite: INEG 2333. (Typically offered: Irregular)

INEG 4812H. Honors Industrial Engineering Research Experience III. 2 Hours.
Completion of an undergraduate research thesis. Introduction to the identification of outlets for dissemination of industrial engineering research. Introduction to the process of identifying opportunities for future extensions of completed research. Prerequisite: INEG 3812H and honors standing. (Typically offered: Fall)

INEG 4833. Introduction to Database Concepts for Industrial Engineers. 3 Hours.
An introduction to the basic principles of database modeling and technologies for industrial engineers. Coverage includes analyzing user requirements, representing data using conceptual modeling techniques (e.g., UML, ERD), converting conceptual models to relational implementations via database design methodologies, extracting data via structured query language processing, and understanding the role of database technology in industrial engineering application areas such as inventory systems, manufacturing control, etc. The application of a desktop database application such as Access will be emphasized. Prerequisite: CSCE 2004. (Typically offered: Irregular)

INEG 4911. Industrial Engineering Capstone Experience I. 1 Hour.
Develop a written and oral proposal for a comprehensive project for an industrial sponsor. Conduct background research, data collection, and preliminary analysis using industrial engineering tools; define objectives, performance measures, and deliverables; identify and schedule required tasks. Pre- or Corequisite: INEG 2001, INEG 3613, INEG 3623, INEG 3714 or INEG 4433 and INEG 4553. (Typically offered: Fall)

INEG 4923. Industrial Engineering Capstone Experience II. 3 Hours.
Develop a written and oral report for a comprehensive project for an industrial sponsor. Complete identified tasks and measure success in achieving defined objectives using industrial engineering tools; create and document deliverables. Students must have successfully completed INEG 4911 in the immediately prior semester. Two hours lecture, One, three hour lab. Corequisite: Lab component. Pre- or Corequisite: INEG 3513. Prerequisite: INEG 3613, INEG 3623, and INEG 4911. (Typically offered: Spring)

INEG 5123. Industrial Engineering in the Service Sector. 3 Hours.
Review of the development of industrial engineering into the service sector, e.g., health care systems, banking, municipal services, utilities, and postal service. Emphasizes those principles and methodologies applicable to the solutions of problems within the service industries. Prerequisite: Graduate standing. (Typically offered: Irregular)

This course is cross-listed with OMG 5133.

INEG 513V. Master's Research Project and Report. 1-6 Hour.
Required course for students electing the report option. (Typically offered: Fall, Spring and Summer)

INEG 514V. Special Topics in Industrial Engineering. 1-3 Hour.
Consideration of current industrial engineering topics not covered in other courses. Prerequisite: Graduate standing. (Typically offered: Irregular) May be repeated for up to 6 hours of degree credit.
INEG 5103. Introduction to Probability. 3 Hours.
Prerequisite: MATH 2574 and INEG 2313. (Typically offered: Fall)

INEG 515V. Individual Study in Industrial Engineering. 1-3 Hour.
Opportunity for individual study of advanced subjects related to a graduate industrial engineering program to suit individual requirements. Prerequisite: Graduate standing. (Typically offered: Fall, Spring and Summer)

INEG 5163. Introduction to Modern Statistical Techniques for Industrial Applications. 3 Hours.
This application-oriented course is driven by real problems arising from industry and focuses on problem solving using both modern and classic statistical methods. For both senior undergraduate and graduate students, the main goal of this course is to provide a comprehensive introduction to those most popular statistical learning methods and tools (such as R and Apache Spark) which are widely used in industry today. For graduate students, this course will also cover the fundamental theory behind some of the methodologies. Students will not receive credit for both INEG 4103 and INEG 5103. Prerequisite: INEG 2333. (Typically offered: Spring)

INEG 5243. Automated Manufacturing. 3 Hours.
Introduction to manufacturing processes and concurrent engineering in the electronics industry. Survey of electronics components and products and the processes of fabrication and assembly. Principles of design, productivity, quality, and economics. Emphasis on manufacturability. (Typically offered: Irregular)

INEG 5253. Leadership Principles and Practices. 3 Hours.
The course is designed to expose students to multiple approaches to leadership in a wide variety of settings. Leadership styles, the knowledge areas and competencies expected of today's leaders, the challenges leaders face, the historical and philosophical foundations of leadership, the relationships among leadership theory, leadership practice, and the moral-ethical aspects of leadership are among the topics covered in the course. A number of respected regional, national, and international leaders share "lessons learned" in their leadership journeys. Plus, a number of highly regarded leadership books and case studies on leadership are read and discussed. Students may not receive credit for INEG 4253 and INEG 5253/OMGT 5253. (Typically offered: Fall)

This course is cross-listed with OMGT 5253.

INEG 5263. Engineering Statistics. 3 Hours.
A graduate level engineering statistics course covering functions of random variables, properties and distributions of random samples, theory of statistical inference, and rationales of testing hypotheses and constructing confidence intervals. Prerequisite: MATH 2574 and INEG 2313. (Typically offered: Fall)

INEG 5313. Engineering Applications of Probability Theory. 3 Hours.
Introduction to probability, discrete random variables, continuous random variables, multiple random variables, sequences of Bernoulli trials. Applications of these topics from inventory, reliability, quality control. (Typically offered: Fall)

INEG 5323. Engineering Applications of Stochastic Processes. 3 Hours.
Renewal processes, Poisson processes, discrete-time Markov chains, continuous-time Markov chains. Applications of these topics from inventory, reliability, quality control, queueing. (Typically offered: Spring)

INEG 5333. Design of Industrial Experiments. 3 Hours.
Statistical analysis as applied to problems and experiments in engineering and industrial research; experiment design and analysis; probability; and response surface analysis. Prerequisite: INEG 2313 or equivalent. (Typically offered: Irregular)

INEG 5343. Advanced Quality Control Methods. 3 Hours.
Acceptance sampling by attributes; single, double, sequential, and multiple sampling plans; sampling plans; sampling plans of Department of Defense; acceptance sampling by variables; Bayesian acceptance sampling; rectifying inspection for lot-by-lot sampling; control charts; special devices; and procedures. Prerequisite: INEG 2313. (Typically offered: Irregular)

INEG 5373. Repairable Systems Modeling. 3 Hours.
Applications of probability, statistics, simulation and optimization to problems related to 1) modeling the performance of repairable equipment; 2) designing optimal inspection and maintenance policies for repairable equipment; and 3) optimizing the allocation of maintenance resources. (Typically offered: Irregular)

INEG 5383. Risk Analysis for Transportation and Logistics Systems. 3 Hours.
Fundamentals of modeling risk, analyzing risk, and managing risk in a variety of industrial and government decision-making settings. Risk measurement and model building, uncertainty quantification, and multi-objective trade-offs. Credit cannot be earned for both INEG 4383 and INEG 5383. (Typically offered: Irregular)

INEG 5393. Applied Regression Analysis for Engineers. 3 Hours.
Present concepts and applications to introduce statistical tools for discovering relationships among variables. Focus on fitting and checking linear and nonlinear regression models. Practical tools for engineers. (Typically offered: Irregular)

INEG 5423. Advanced Engineering Economy. 3 Hours.
(Formerly INEG 4423.) Preparation of feasibility studies, including cost estimation, risk and uncertainty, sensitivity analysis and decision making. Effects of taxes, depreciation and financing costs on cash flows. Graduate degree credit will not be given for both INEG 4423 and INEG 5423. Prerequisite: INEG 2133 and INEG 2413. (Typically offered: Irregular)

INEG 5433. Cost Estimation Models. 3 Hours.
Overview of cost estimation techniques and methodologies applied to manufacturing and service organizations. Accomplished through detailed analysis of the cost estimation development process and various cost estimation models. Topics include data collection and management, learning curves, activity based costing, detailed and parametric estimation models, and handing risk and uncertainty. Prerequisite: INEG 2313. (Typically offered: Irregular)

This course is cross-listed with OMGT 5433.

INEG 5443. Decision Models. 3 Hours.
Focus on quantitative decision models for technical and managerial problems for private and public organizations. Topics include shareholder value, stakeholder value, Value-Focused Thinking, axioms of decision analysis, decision making challenges, decision traps, cognitive biases, decision processes, decision framing, influence diagrams, value hierarchy structuring, designing creative alternatives, singe objective models, multiobjective additive value model, swing weights, sensitivity analysis, portfolio decision models with binary linear programming, probability elicitation, Bayes Law, decision trees, Monte Carlo simulation, expected value, dominance (deterministic and stochastic), tornado diagrams, value of information, risk preference, utility models, expected utility, and communicating analysis insights. Prerequisite: INEG 2313. (Typically offered: Irregular)

This course is cross-listed with OMGT 5443.

INEG 5453. Systems Engineering and Management. 3 Hours.
(Formerly INEG 4433.) Overview of the fundamental concepts underlying the management of engineering. Reviews the engineering decision process within the life cycle. Examines implementation of basic management functions in technical organizations and development of strategy tools within a complex organization. Graduate degree credit will not be given for both INEG 4433 and INEG 5453. Prerequisite: INEG 2403. (Typically offered: Fall)

INEG 5463. Project Management. 3 Hours.
(Formerly INEG 4443.) Analysis of the strategic level of project management including planning, organizing, and staffing for successful project execution. Professional creativity, motivation, leadership, and ethics are also explored. At the tactical level, project selection, control, and systems management are analyzed. System's development and decision support tools for project management are studied. Graduate degree credit will not be given for both INEG 4443 and INEG 5463. (Typically offered: Irregular)
INEG 5523. Topics in Automated Systems. 3 Hours.
To understand current developments in applications of flexible automation to industrial processes. Robotics, machine vision and other sensors, human machine interface, AML/2 and V+ programming languages. (Typically offered: Irregular)

INEG 5533. Network Optimization in Transportation Logistics. 3 Hours.
Focus on quantitative modeling and analysis of network optimization problems and their application in logistics system design and operation. Topics include network design and routing and location analysis, with emphasis on the application of both exact and heuristic solution techniques for large-scale instances of such problems. Prerequisite: INEG 5613. (Typically offered: Spring)

INEG 5543. Distribution Center Design & Operations. 3 Hours.
To introduce the student to the field of facility logistics, as applied to distribution centers (DCs). The fundamental areas of facility design and operations (material handling systems) will be covered. Prerequisite: INEG 5613. (Typically offered: Irregular)

INEG 5563. Industrial Robotics. 3 Hours.
An interdisciplinary treatment of industrial robotics; manipulator anatomy, control, and programming; end-of-arm tooling; sensors & sensing; system integration and safety; current research topics. Graduate-level lab assignments and examinations. Significant literature review and writing assignments. Not open to students with credit for INEG 4563. Prerequisite: Graduate standing or instructor consent. (Typically offered: Fall)

INEG 5613. Introduction to Optimization Theory. 3 Hours.
A graduate level introduction to the foundational rationales of numerical optimization methods including linear programming, integer programming, network flows, and discrete dynamic programming. Model formulation and tractability, search strategies, characterization of optimal solutions, duality and sensitivity, outcome justification. Prerequisite: Graduate standing. (Typically offered: Fall)

INEG 5623. Analysis of Inventory Systems. 3 Hours.
Elements of production and inventory control, economic lot size models, price breaks models using Lagrangian method, deterministic dynamic inventory model, probabilistic one-period and multi-period models, zero and positive lead time models, and continuous review models. Prerequisite: INEG 5313. (Typically offered: Irregular)

INEG 5643. Optimization Theory II. 3 Hours.
Classical optimization theory, Lagrangian and Jacobian methods, Kuhn-Tucker theory and constraint qualification, duality in nonlinear problems; separable programming, quadratic programming, geometric programming, stochastic programming, steepest ascent method, convex combinations method, SUMT, Fibonacci search, and golden section method. Prerequisite: INEG 5613. (Typically offered: Irregular)

INEG 5653. Modeling and Analysis of Semiconductor Manufacturing. 3 Hours.
Introduction to front end of semiconductor manufacturing process, wafer processing. Topics include an introduction to wafer processing, factory and equipment capacity modeling, automated material handling, simulation, cost modeling, and production scheduling. Prerequisite: INEG 4613. (Typically offered: Irregular)

INEG 5663. Analysis of Queuing Systems. 3 Hours.
Random number generation, random variate generation, timekeeping in simulations, coverage and simulation results, and analysis of simulation experiments utilizing a computer programming language. (Typically offered: Irregular)

INEG 5673. Nonlinear Programming. 3 Hours.
An introduction to the theory and methodology of nonlinear programming. Focus on engineering and management science applications of nonlinear optimization. Both single and multi-variable as well as unconstrained and constrained problems are addressed. (Typically offered: Irregular)

INEG 5963. Heuristic Optimization. 3 Hours.
Theory and applications of methodological approaches explicitly addressed to heuristic or approximate optimization of integer and combinatorial models. Prerequisite: INEG 5613. (Typically offered: Irregular)

INEG 5983. Simulation. 3 Hours.
The development and use of discrete-event simulation models for the analysis and design of systems found in manufacturing, distribution, and service contexts. Coverage includes conceptual modeling, model translation to computer form, statistical input models, random number generation and Monte Carlo methods, experimentation and statistical output analysis, and queuing analysis. Includes the use of modern computer simulation languages. Cannot receive credit for both INEG 3623 and INEG 5803 Corequisite: Drill component. (Typically offered: Irregular)

INEG 5981. Introduction to Simulation. 3 Hours.
Development and use of discrete-event simulation models for the analysis and design of systems found in manufacturing, distribution, and service contexts. Coverage includes conceptual modeling, model translation to computer form, statistical input models, random number generation and Monte Carlo methods, experimentation and statistical output analysis, and queuing analysis. For off-campus, distance education students only. (Typically offered: Irregular)

INEG 5982. Systems Simulation I. 3 Hours.
Random number generation, random variate generation, timekeeping in simulations, discrete event modeling, construction of digital simulation models, statistical analysis of simulation results, and analysis of simulation experiments utilizing a computer programming language. (Typically offered: Irregular)

INEG 5983. Introduction to Database Concepts for Industrial Engineers. 3 Hours.
(Formerly INEG 4833.) An introduction to the basic principles of database modeling and technologies for industrial engineers. Coverage includes analyzing user requirements, representing data using conceptual modeling techniques (e.g. UML, ERD), converting conceptual models to relational implementations via database design methodologies, extracting data via structured query language processing, and understanding the role of database technology in industrial engineering application areas such as inventory systems, manufacturing control, etc. The application of a desktop database application such as Access will be emphasized. Graduate degree credit will not be given for both INEG 4833 and INEG 5833. (Typically offered: Irregular)

INEG 5984. Scheduling and Sequencing I. 3 Hours.
An introduction to constructive algorithms and various operations research approaches for solving sequencing and scheduling problems. The NP-completeness of most scheduling problems leads to a discussion of computational complexity, the use of heuristic solution methods, and the development of worst case bounds. Prerequisite: INEG 3613 and computer programming proficiency. (Typically offered: Irregular)

INEG 600V. Master's Thesis. 1-9 Hours.
Master's Thesis. (Typically offered: Fall, Spring and Summer) May be repeated for degree credit.

INEG 6113. Linear Optimization. 3 Hours.
A precise treatment of linear programming. Theory of convex sets, linear inequalities; development of the simplex method; duality theory; post optimality application and interpretation. Variants of the simplex methods and interior-point algorithms are discussed. Prerequisite: INEG 5613. (Typically offered: Fall)

INEG 614V. Special Topics for Doctoral Students in Industrial Engineering. 1-3 Hour.
Consideration of current industrial engineering topics at the doctoral level that are not covered in other courses. Prerequisite: PhD student in Industrial Engineering or consent of the instructor. (Typically offered: Irregular) May be repeated for up to 6 hours of degree credit.
INEG 6213. Integer Programming. 3 Hours.
This course offers the theory needed to model and efficiently solve large-scale binary, mixed and general integer programs. The tools needed to assess the computational complexity of these problems will be fully studied. Additional topics include the conceptual foundation required for the development of cutting plane, branch-and-price, Lagrange relaxation and constraint programming approaches. Implementation considerations specific to preprocessing, valid inequality generation and solution methodology convergence will be emphasized. Prerequisite: INEG 6113. (Typically offered: Spring)

INEG 6313. Network Optimization. 3 Hours.
A theorem-proof based advanced study providing rigorous exposition of foundational network optimization concepts including relevant optimization theory, algorithm development techniques, complexity analysis, data structures, and important applications. Prerequisite: INEG 6113. (Typically offered: Fall)

INEG 6363. Generalized Linear Models. 3 Hours.
Introduce the generalized linear model (GLM), inference, likelihood and diagnostics. Apply log linear and logistic models. Develop techniques for growth curves, and longitudinal and survival data. Cover spatial and normal linear models, and dynamic GLM for dependent data. (Typically offered: Irregular)

INEG 6443. Advanced Decision Analysis. 3 Hours.
The purpose of this course is to prepare the student to perform PhD and MS level research and analysis using advanced decision analysis concepts and techniques. The course topics include the history of decision analysis, foundations of decision analysis, structuring decision problems, assessing probabilities, probability management, Bayesian networks, utility, risk preference, risk analysis for engineering applications, intelligent adversary risk analysis, behavioral and organizational context for decision analysis, and major decision analysis applications. Prerequisite: INEG 5443. (Typically offered: Spring)

INEG 6823. Systems Simulation II. 3 Hours.
Advanced topics in computer simulation including experimental design, simulation optimization, variance reduction, and statistical output analysis techniques applied to discrete event simulation. Prerequisite: INEG 5823. (Typically offered: Irregular)

INEG 6843. Scheduling Theory and Algorithms. 3 Hours.
The course will cover the theory and solution methods for scheduling several tasks over time. Topics include terminology, measures of performance, single machine sequencing, flow shop scheduling, the job shop problem, and priority dispatching. Side constraints within scheduling, such as precedence, release dates, and due dates are addressed. Integer programming, dynamic programming, and heuristic approaches to various problems are also presented. Prerequisite: INEG 5613 or equivalent, computer programming proficiency, and exposure to proofs. (Typically offered: Irregular)

INEG 700V. Doctoral Dissertation. 1-18 Hour.
Doctoral Dissertation. (Typically offered: Fall, Spring and Summer) May be repeated for degree credit.