

# INDUSTRIAL ENGINEERING

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## Department Mission Statement

The Department of Industrial Engineering mission is to provide contemporary and relevant industrial and systems engineering education and research; impart knowledge and skills necessary to design and to improve a variety of manufacturing and service processes; promote life-long learning; and contribute to emerging societal needs.

## Degree Programs

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

- B.S/M.S. Dual Degree in Industrial Engineering
- Master of Science in Industrial Engineering
- Master of Science in Environmental Health and Safety
- MSIE/MBA Weekend Executive Program (in conjunction with the School of Business)
- Master of Science in Management of Technology (in conjunction with the School of Business)

The Department also offers:

- Ph.D. in Industrial Engineering.

## Masters Program in Industrial Engineering

- M.S. in Industrial Engineering (<http://bulletin.miami.edu/graduate-academic-programs/engineering/industrial-engineering/industrial-engineering-ms/>)
- M.S. in Environmental Health and Safety (<http://bulletin.miami.edu/graduate-academic-programs/engineering/industrial-engineering/environmental-health-safety-ms/>)
- M.S. in Management of Technology (<http://bulletin.miami.edu/graduate-academic-programs/engineering/industrial-engineering/management-technology-ms/>)

## Doctoral Program in Industrial Engineering

- Ph.D. in Industrial Engineering (<http://bulletin.miami.edu/graduate-academic-programs/engineering/industrial-engineering/industrial-engineering-phd/>)

### IEN 601. 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.

Prerequisite: IEN 301.

**Components:** LEC.

**Grading:** GRD.

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

### IEN 602. 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.

### IEN 605. 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.

**Components:** LEC.

**Grading:** GRD.

**IEN 607. 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.

Requisite: Graduate Standing.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**IEN 612. Statistical Quality Control and Quality Management. 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 and process capability studies, acceptance sampling, as well as Quality Function Deployment (QFD) and introduction to reliability. Also covered in the course are Lean Six Sigma methodology, tools and concepts.

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

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**IEN 613. 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.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**IEN 616. 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: IEN 442 And IEN 312.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**IEN 624. Decision Support Systems in Industrial Engineering. 3 Credit Hours.**

Theory and application of decision support systems in industrial engineering. Topics include the study of model-based, data-based, knowledge-based, and communication-based decision support systems. Emphasis is placed on the selection process of the appropriate systems for various decision problems in industrial environments.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**IEN 647. Computer Simulation Systems. 3 Credit Hours.**

Computer simulation and the development of simulation models. Application of discrete and continuous system simulation languages to systems studies is also included.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall & Spring.

**IEN 648. 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: IEN 310. And IEN 441.

**Components:** LEC.

**Grading:** GRD.

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

**IEN 651. Accident Prevention Systems. 3 Credit Hours.**

Introduction to the basic principles of accident prevention and how to apply the safety engineering approach to the design of industrial accident prevention systems

Prerequisites: IEN 311 and IEN 351.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**IEN 654. 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: IEN 557. Or BME 375.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**IEN 657. 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.

Requisite: Graduate Standing.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**IEN 658. Industrial Hygiene I. 3 Credit Hours.**

Recognition of occupational chemical health hazards. Evaluation methods and analytical procedures used to determine level of exposure to chemical and toxic hazards. Control measures and compliance with OSHA requirements with special emphasis on industrial ventilation, and other methods of control are included.

Prerequisite: IEN 557.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**IEN 668. Materials Handling and Facilities Planning. 3 Credit Hours.**

Analysis and design of production and service facilities, emphasis on material handling requirements. Capacity requirements, facility location, layout, storage systems and warehousing are discussed

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**IEN 670. Engineering Management. 3 Credit Hours.**

Integrating engineering discipline into the social and economic considerations of managing systems. Tools and techniques used by engineering managers including engineering project life cycle, role playing, communication, decision-making in engineering management, and managing change in engineering organizations are discussed.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**IEN 671. Engineering Entrepreneurship. 3 Credit Hours.**

The conversion of technological know-how and engineering theories into business enterprises. The role of technology in creating wealth, connecting technology with market, the role and characteristics of entrepreneurs, starting a business and the business plan, innovation, industrial and service organizations, and the new business environment.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**IEN 672. 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.

Prerequisite: IEN 572.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**IEN 690. Special Topics in Industrial Engineering. 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.

**IEN 694. Master's Capstone Design Project. 3 Credit Hours.**

A capstone design project for students in the five-year BSIE/MSIE program. Integration of Industrial Engineering principles and techniques in the design and improvement of production and service systems is emphasized. Offered for students in this program only.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall & Spring.

**IEN 695. 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.

**IEN 696. 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.

**IEN 699. 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.

**IEN 712. Design of Experiments. 3 Credit Hours.**

Design and analysis of experiments, randomized blocks, Latin Squares, factorials, multiple correlation and regression, and application to response surfaces are discussed. 3 hours.

Prerequisite: IEN 311 or MAS 311 or equivalent.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**IEN 713. Applied Regression Analysis. 3 Credit Hours.**

Theory and applications of regression based models. Focus will be on empirical model building, estimation, inference and prediction with emphasis on interpretation of results and understanding model assumptions. Key Topics will be linear regression, panel data and time series analysis.

Prerequisite: IEN 311.

**Components:** LEC.

**Grading:** GRD.

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

**IEN 715. Quality Through Planned Experimentation. 3 Credit Hours.**

Sequential experimentation and guidance on how to build the sequence and use graphical methods to ascertain how much the planned changes contribute to the variation in the data. Experimentation is presented as a system in the context of a model to improve quality and integrate statistical process control (SPC) with methods of design. Examples presented contain problems often encountered in actual experimentation in a manufacturing or a service facility. Not open to students with credit in IEN 712.

**Components:** LEC.

**Grading:** GRD.

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

**IEN 716. Advanced Quality Control. 3 Credit Hours.**

Advanced topics in variables and attributes acceptance sampling and control charting. Statistical and economical design of control chart and sampling plan, sampling design and analysis with inspection and measurement errors, product liability prevention, value engineering, quality costs, Metrology, military standards, quality manuals, customer and vendor relations, and total quality control concepts are discussed.

**Components:** LEC.

**Grading:** GRD.

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

**IEN 742. Linear Programming and Extensions. 3 Credit Hours.**

Formulation, solution, postoptimality analysis of linear programming problems; revised simplex, parametric programming, decomposition of large-scale systems. Use of computer packages. Introduction to integer programming, network flows, and nonlinear programming applications.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**IEN 747. Data Driven Multi-paradigm Simulation Systems. 3 Credit Hours.**

The goal of this course to familiarize the students with current research problems in the simulation field including 1) various modeling paradigms (discrete event, system dynamics, agent-based approach, O-O modeling, Petri-net), 2) modeling enhancement in discrete event simulation, 3) standards, methods, techniques, and cyber-infrastructures (web services and grid computing) enabling distributed simulation, 4) algorithms for partitioning a large scale simulation into smaller pieces, and 5) real-time simulation and simulation based control. If time permits, the course will also cover 6) simulation optimization techniques using search algorithms and 7) deadlock detection and resolution in simulation. This course will help graduate students identify potential research topics in simulation principles for the application areas in design and control for complex data driven systems.

Prerequisite: IEN 547 or IEN 647.

**Components:** PBL.

**Grading:** GRD.

**Typically Offered:** Spring.

**IEN 757. Ergonomics and Occupational Biomechanics. 3 Credit Hours.**

Effects of human factors in the improvement of performance of systems. Human capacities, capabilities, and limitations as derived from anatomical, physiological, and psychological principles are applied to the design of tools and equipment. Incorporation of all factors into systems design to achieve better system performance is emphasized

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**IEN 758. Ergonomics and Special Populations. 3 Credit Hours.**

Ergonomic issues relevant to design for older adults and special populations such as the handicapped. Primary emphasis is placed on work environments, transportation and communication systems, and home environments. Topics include cognitive and physiological characteristics of special populations, workplace design, job and equipment design, rehabilitation engineering, clinical ergonomics, and legislation such as the ADA. Lecture, 3 hours.

**Components:** LEC.

**Grading:** GRD.

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

**IEN 760. Productivity Measurement and Evaluation. 3 Credit Hours.**

Basic concepts. Productivity measurement approaches at international, national, industry, and company levels. Latest measurement models for manufacturing companies. Relationships between total and partial productivities, profit and total productivity. Productivity evaluation: theory and methodology.

**Components:** LEC.

**Grading:** GRD.

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

**IEN 761. Engineering Cost Management. 3 Credit Hours.**

Issues of cost management, including activity based costing of engineering projects. A detailed study of how to separate, identify, understand and manage the major activities performed, and how these activities relate to customer needs. Overall view of costs associated with products, processes, and customers.

**Components:** LEC.

**Grading:** GRD.

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

**IEN 763. Project Management Techniques. 3 Credit Hours.**

Techniques and Tools in Project Management. Use of network flow techniques including PERT/CPM, planning, systems concepts, time management, conflicts, cost and resource control, tradeoff analysis.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**IEN 764. Supply Chain Management. 3 Credit Hours.**

Supply Chain Management focuses on the flow of products, information, and money throughout the supply chain. An overview of issues, opportunities, tools, and approaches is provided. Emphasis is placed on business processes, system dynamics, control, design and re-engineering, and on the relationship between the supply chain and the company's strategic position relative to its clients and its competition. The dimensions of inter-corporate relationships with partners, including decision-making, incentives, and risk are also covered.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**IEN 765. Advanced Production Systems. 3 Credit Hours.**

Quantitative, heuristic and computer methods applied to problems of production planning, work force balancing and capacity expansion. Sequencing and scheduling models. Advanced Material Requirements Planning (MRP II). Just In Time production systems (JIT). Master Production Scheduling (MPS). Optimize Production Technology (OPT). KANBAN production planning system. Learning curve theory. Advanced forecasting and time-series analysis.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**IEN 772. Strategic Management of Technological Innovation.. 3 Credit Hours.**

Advanced topics in the management of technology emphasizing the relationship between technology and competitiveness in the global marketplace. Technology development in the U.S., Japan, and Europe, industrial R & D, strategic technological planning, and conditions for successful implementations. Case studies are used with individual and group assignments. Prerequisite: IEN 572 - Management of Technology or permission of Instructor.

**Components:** LEC.

**Grading:** GRD.

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

**IEN 791. Industrial Engineering Seminar. 0 Credit Hours.**

Oral presentation and discussion of current topics in Industrial Engineering.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall & Spring.

**IEN 792. Professional Communications Skills for Engineering Grad Students. 0 Credit Hours.**

This course covers fundamental areas in professional communication for Engineering graduate students. Topic areas include: presenting research at conferences, writing manuscripts for publication, preparing the dissertation, the PhD comprehensive exams, effective teaching and mentoring, and obtaining positions in academia. Through interactive workshops, in-class exercises, brief presentations and assignments, students will have an opportunity to practice and strengthen necessary communication skills, developing collaborations, and developing effective presentation skills.

**Components:** MOD.

**Grading:** SUS.

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

**IEN 794. Master's Project. 3 Credit Hours.**

A capstone project for M.S. students in the non-thesis option.

**Components:** THI.

**Grading:** GRD.

**Typically Offered:** Fall & Spring.

**IEN 795. Special Problems. 1-3 Credit Hours.**

Research and/or design projects through an individual investigation of current problems. Offered by special arrangement only.

**Components:** THI.

**Grading:** GRD.

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

**IEN 796. Special Problems. 1-3 Credit Hours.**

Research and/or design projects through an individual investigation. of current problems. Offered by special arrangement only.

**Components:** LEC.

**Grading:** GRD.

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

**IEN 799. Advanced Topics. 1-3 Credit Hours.**

Subject matter offerings based upon student demand and availability of faculty. Subtitles describing the topics to be offered will be shown in parentheses in the printed class schedule, following the title "Advanced Topics".

**Components:** LEC.

**Grading:** GRD.

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

**IEN 810. Master's Thesis. 1-6 Credit Hours.**

The student working on his/her master's thesis enrolls for credit, in most departments not to exceed six, as determined by his/her advisor. Credit is not awarded until the thesis has been accepted.

**Components:** THI.

**Grading:** SUS.

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

**IEN 820. Research in Residence. 1 Credit Hour.**

Used to establish research in residence for the thesis for the master's degree after the student has enrolled for the permissible cumulative total in IEN 710 (usually six credits). Credit not granted. May be regarded as full time residence.

**Components:** THI.

**Grading:** GRD.

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

**IEN 825. Continuous Registration--Master's Study. 1 Credit Hour.**

To establish residence for non-thesis master's students who are preparing for major examinations. Credit not granted. Regarded as full time residence.

**Components:** LEC.

**Grading:** GRD.

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

**IEN 830. Pre-Candidacy Doctoral Dissertation. 1-12 Credit Hours.**

Doctoral dissertation credits taken prior to Ph.D. student's candidacy. The student will enroll for credit as determined by his/her advisor. Not more than 12 hours of IEN 730 may be taken in a regular semester, nor more than six in a summer session.

**Components:** THI.

**Grading:** SUS.

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

**IEN 840. Post-Candidacy Doctoral Dissertation. 1-12 Credit Hours.**

Doctoral dissertation credits taken after Ph.D. student has been admitted to candidacy. The student will enroll for credit as determined by his/her advisor. Not more than 12 credits in IEN 740 may be taken in a regular semester, nor more than six credits in a summer session.

**Components:** THI.

**Grading:** SUS.

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

**IEN 850. Research in Residence. 1 Credit Hour.**

Used to establish research in residence for the Ph.D. and D.A., after the student has been enrolled for the permissible cumulative total in appropriate doctoral research. Credit not granted. May be regarded as full-time residence as determined by the Dean of the Graduate School.

**Components:** THI.

**Grading:** SUS.

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