

Industrial Engineering

Department of Industrial and Systems Engineering

School of Engineering and Applied Sciences
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Overview

The Industrial and Systems Engineering (ISE) department at UB offers a full range of undergraduate and graduate programs in industrial and systems engineering, including an accredited bachelor of science degree in Industrial Engineering (BSIE).

Graduates from UB's BSIE program will achieve the following professional goals:

Think critically and creatively to identify, define, and solve important and relevant industrial engineering problems through careers in industry, government, and academia;

Engage in life-long learning through professional development and further graduate education;

Function effectively, at all levels of an organization, in settings that are diverse, global and multi-disciplinary;

Communicate effectively to diverse audiences, through all appropriate formats;

Promote the Industrial Engineering profession through participation in outreach, civic, educational, or professional society activities.

Industrial engineers apply knowledge from mathematical, physical, information and human sciences to study, design and improve systems which combine people, computers, automation, transportation, energy, and information. A B.S. degree in industrial engineering from UB leads to fascinating careers in industries as diverse as airline operations, automotive manufacturing, health services, military operations, and financial services. IE graduates have maximum flexibility to pursue their goals for advancement in management as well as systems design.

At UB, students are taught by award-winning faculty, and can learn about and participate in cutting-edge research in areas such as biomedical prototyping, human-computer interaction, design for disabled individuals, hazardous materials routing, aviation safety and security, and data mining.

IEs are well suited to solve modern management problems, using sophisticated quantitative analysis, and dealing with highly technical issues. With the rapid infusion of computer technology into manufacturing processes and service systems, coupled with the demand for higher product quality in a competitive marketplace, IEs are in a special position to tackle many corporate challenges.

All undergraduate IE students are required to complete a faculty supervised, industry based internship - we make sure students have the job skills they will need.

At our departmental website, <http://www.ie.buffalo.edu>, there is a complete description of the department, profiles of current students and faculty, and exciting news and events about the students, faculty, and research programs in IE.

About our Degrees

Acceptance Criteria

See the [School of Engineering and Applied Sciences](#) Acceptance Criteria in the Undergraduate Catalog

Current Application Information

Students can select IE as a major if they are students in good standing within the School of Engineering and Applied Sciences, or when they apply to UB. Non-engineering students seeking to change their major to IE should first apply to the [School of Engineering and Applied Sciences](#).

Degree Requirements

Please see [Degrees and Policies](#).

About our Courses

Freshman and sophomore course requirements are consistent with those of other engineering departments, and consist of mathematics,

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physical (and/or biological) sciences, engineering science, and computer programming. It is simple to transfer among engineering majors in the freshman and sophomore years.

Junior and senior level IE courses focus on the application of mathematics and engineering science to IE problems in areas of operations research, human factors, facility design, engineering economy, quality control, production planning, and simulation.

Many IE courses take advantage of UB's technologically equipped classrooms. The IE department provides its students with a computing laboratory equipped with state of the art software, as well as a recently renovated manufacturing and human factors laboratory.

Our students have the flexibility to take technical electives from a broad range of disciplines including behavioral sciences, engineering, mathematics, computer science, and management.

The typical class size for:

Freshman/introductory courses is: over 100 (engineering-wide courses)

Sophomore/intermediate courses is: 50-80 (engineering-wide courses)

Upper level/advanced courses is: 20-40 (industrial engineering courses)

In the Department of Industrial Engineering, what do teaching assistants (TAs) do?

TAs hold office hours to answer students' questions about homework and exam preparation, grade homework (exams are normally graded by instructors), manage lab assignments, and hold recitation sessions.

For course descriptions, please see [Courses](#).

About our Faculty

Undergraduate IE students at UB have access to award-winning faculty who maintain high standards in teaching and research activities in diverse expertise areas (Human Factors, Operations Research, and Production Systems). The Department of Industrial and Systems Engineering has eleven full-time faculty, and seven affiliated or adjunct faculty, all holding a Ph.D. degree. Class sizes in IE are small (often less than forty students) insuring personal connections between students and faculty. In addition to teaching undergraduate courses, our faculty regularly involve undergraduate students in ongoing engineering research. In surveys of our graduating seniors, interactions with faculty are consistently cited as one of the best aspects of the department.

The Undergraduate Director, Dr. Ann Bisantz, can be contacted at bisantz@buffalo.edu.

See a list of our [Undergraduate Faculty](#).

Acceptance Information

Students admitted to the [School of Engineering and Applied Sciences](#) may select IE as a major (current students in SEAS must be in good standing to transfer to IE). See the School of Engineering and Applied Sciences [Acceptance Information](#)

Transfer Policy

Transfer students must first apply to the university and meet the university transfer admission requirements. For admission of transfer students to engineering, see the School of Engineering and Applied Sciences [Transfer Policy](#)

Extracurricular Activities

Our undergraduate students are active in student chapters of many national professional societies, including:

[Institute of Industrial Engineers \(IIE\)](#)

[Human Factors and Ergonomics Society](#)

[Society of Manufacturing Engineering \(SME\)](#)

[American Society for Quality \(ASQ\)](#)

[INFORMS](#)

[Alpha Pi Mu](#), the industrial engineering honor society

[Omega Rho](#), the operations research honor society

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[Tau Beta Pi](#), the engineering honor society

See the [UB Student Association](#).

Practical Experience and Special Academic Opportunities

Notable Program Features

Many IE courses take advantage of UB's technologically equipped classrooms. The IE department provides its students with a computing laboratory equipped with state of the art software, as well as a recently renovated manufacturing and human factors laboratory.

Our students have the flexibility to take technical electives from a broad range of disciplines including behavioral sciences, engineering, mathematics, computer science, and management.

Undergraduate Research and Practical Experience

Undergraduates are encouraged to work with faculty members on independent study (student initiated) or participate in faculty members' ongoing research involving studies of systems, humans, and their interaction. Students may receive academic credit or in some cases may be paid as undergraduate research assistants. Recently, undergraduates have participated in projects involving aviation safety and security, production systems, and human decision-making. Students may complete a senior thesis if appropriate.

Internships and Co-op Opportunities

All undergraduate IE students complete supervised projects as a required part of the IE curriculum. These projects are completed as a one-day per week internship during the spring semester of the senior year. Students can also take advantage of the co-op program administered through the School of Engineering and Applied Sciences, which blends work experiences with an undergraduate degree. Please visit <http://www.eng-intern.buffalo.edu/> for more information.

Honors, Awards, and Scholarships

The department annually awards the Frederick Thomas Scholarship and the Thomas-Karwan Scholarship to outstanding undergraduate students; and the John Zahorjan scholarship for Master of Engineering study; students are also eligible for a number of other School of Engineering scholarships.

Career Information and Further Study

Career Choices:

- Ergonomist
- Facilities designer
- Human-computer interface design
- Logistics analyst
- Manufacturing or operations supervisor
- Manufacturing systems engineer
- Operations analyst
- Process engineer
- Quality control specialist/engineer
- Safety engineer
- Space planner

Work settings include:

Banking/finance, manufacturing, health, transportation, social services, construction, facilities design, government, military, libraries and educational systems.

What percentage of graduates goes on to find related employment?

A recent survey of our alumni indicated that 100% of those responding have had, or currently hold, positions related to industrial engineering.

Salary Information

The U.S. Department of Labor Bureau of Labor Statistics has great news for those who want to pursue careers in industrial engineering. In spite of the declining manufacturing industry in the U.S., industrial engineering employment is expected to grow 20% over the next 8-10 years, almost double the rate of the average for engineering professions and other occupations.

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The Bureau of Labor Statistics also reports that increasing competition and advancing technology will require companies to focus on key industrial engineering tasks such as increasing productivity, output and service quality. Additionally, the growth of the service sector industry in the U.S. has contributed to the demand for engineers.

Earnings for industrial engineers also compared well to other engineering disciplines. According to the US Bureau of Labor Statistics Occupational Outlook Handbook, the starting IE BS salary in 2007 was over \$55,000 and was over \$65,000 for a starting MS. The median income for all IEs was over \$68,000

Post-undergraduate Opportunities

Students who receive a B.S. degree in Industrial Engineering have opportunities for graduate-level work in areas such as human factors, operations research, production and manufacturing systems, production management, and systems engineering. Students may choose to pursue non-engineering degrees such as an M.B.A.

The ISE department at UB offers several five- and six-year programs, including the Combined B.S./M.B.A., the M.Eng. in Production Management, and the M.S. in Industrial Engineering (all five-year programs); as well as the M.S. with specializations in operations research, human factors, or production systems (six-year program).

Degrees Offered

Undergraduate: BS

Combined: BS/MBA

Graduate: MS, MEng, PhD

Special Programs: Six Sigma Certification is available with completion of additional work experiences and examinations (see [department web site](#) for details).

Links to Further Information About this Program

- [Undergraduate Catalog](#)
- [Undergraduate Admissions](#)
- [Graduate Admissions](#)
- [Department of Industrial and Systems Engineering](#)
- [School of Engineering and Applied Sciences](#)

Industrial Engineering - B.S.

Acceptance Criteria

See the [School of Engineering and Applied Sciences Acceptance Information](#).

Note: Please see the School of Engineering and Applied Sciences entry in this catalog for additional requirements.

Advising Notes

Students must meet minimum GPA and residency requirements in engineering as specified by the Dean of Engineering to graduate from the program. See School of Engineering and Applied Sciences [Academic Requirements](#).

Required Courses

Basic science elective ([CHE 108](#), [PHY 207/PHY 257](#), [BIO 200](#) or [BIO 201](#))

[CHE 107](#) General Chemistry for Engineers

[EAS 140](#) Engineering Solutions

[EAS 202](#) Engineering Impact on Society

[EAS 207](#) Statics

[EAS 230](#) Higher-Level Language

[EAS 305](#) Applied Probability

[IE 306](#) Statistical Methods for Engineering

[IE 320](#) Engineering Economy

[IE 323](#) Ergonomics

[IE 326](#) Planning for Production

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[IE 327](#) Facilities Design
[IE 373](#) Introduction to Operations Research: Deterministic Models
[IE 374](#) Introduction to Operations Research: Probabilistic Models
[IE 408](#) Quality Assurance
[IE 420](#) Industrial and Systems Laboratory
[IE 477](#) Digital Simulation
[IE 496](#) Industrial Engineering Internship
[MTH 141](#) College Calculus I
[MTH 142](#) College Calculus II
[MTH 241](#) College Calculus III
[MTH 306](#) Introduction to Differential Equations
[MTH 309](#) Linear Algebra
[PHY 107](#) General Physics I
[PHY 108](#) General Physics II
[PHY 158](#) Physics II Lab

One engineering science elective; must be chosen from [EAS 208](#), [EAS 209](#), [EE 200](#), [EE 202](#), [MAE 204](#).

Six technical electives (three must be IE courses including one of either [IE 441](#) or [IE 435](#) or [IE 436](#); other choices are restricted to those approved by the department).

Summary

Total required credit hours for the major: 112

See [Baccalaureate Degree Requirements](#) for general education and remaining university requirements.

Recommended Sequence of Program Requirements

FIRST YEAR

Fall [CHE 107](#), [EAS 140](#), [MTH 141](#)

Spring [EAS 202](#), [MTH 142](#), [PHY 107](#), basic science elective; [IE 101](#) (optional)

SECOND YEAR

Fall [EAS 207](#), [EAS 230](#), [MTH 241](#), [PHY 108](#), [PHY 158](#)

Spring Engineering science elective, [IE 320](#), [MTH 306](#) or [MTH 309](#).

THIRD YEAR

Fall [EAS 305](#), [MTH 309](#) or [MTH 306](#), [IE 326](#), [IE 323](#)

Spring [IE 306](#), [IE 373](#), [IE 327](#), [IE 374](#)

FOURTH YEAR

Fall [IE 420](#), [IE 477](#), 3 technical electives

Spring [IE 408](#), [IE 496](#), 3 technical electives,

Electives and Course Groupings

Six technical electives are required (four must be IE courses including one of either [IE 441](#) or [IE 435](#); other choices are restricted to those approved by the department).

Other technical electives (TEs) may be drawn from 400 level electives from the Industrial and Systems Engineering Department, 300/400/500-level courses offered by other engineering departments or approved departments in the College of Arts and Sciences or in the School of Medicine and Biomedical Sciences (see the IE director of undergraduate studies for details on departments meeting this criterion). Note that electives which substantively duplicate coursework required for the IE degree, or other electives taken, can NOT be applied to the degree. (Generally, for instance, this precludes using [CIE 308](#) or similar courses for a TE).

Technical electives may also be selected from the list below. **

(Note: Limited space may be available for nonmajors in many of the following courses.)

[CSE 114](#) Introduction to Computer Science II
[CSE 241](#) Digital Systems
[CSE 250](#) Algorithms and Data Structures
[EAS 480](#) Technical Communication or [EAS 483](#) Engineering Procedure Writing (both may not be applied)
[ECO 405](#) Microeconomic Theory
[ECO 406](#) Topics in Microeconomic Theory
[ECO 407](#) Macroeconomic Theory
[MGA 201](#) Introduction to Accounting 1
[MGA 202](#) Introduction to Accounting 2
[PSY 333](#) Psychology of Work in Organizations
[PSY 341](#) Cognitive Psychology
[PSY 342](#) Cognitive Science

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[PSY 343](#) Sensory Processes and Perception

Some 300/400-level management school courses (with approval of the IE Director of Undergraduate Studies)

**Additional courses in management, economics, and psychology may be applied; please see the IE department for additional information and explicit permission to use the course for a technical elective.

Industrial Engineering/Business Administration - B.S / M.B.A

Acceptance Criteria

Good standing as an industrial engineering student and acceptance as a graduate student by the School of Management.

Advising Notes

Students apply directly to the management school during their junior year to be admitted to the MBA program. The MBA courses listed below are representative of those that have been required but may change prior to a students' acceptance into the MBA program. Students should confirm MBA program requirements upon their application & acceptance to that program directly with the School of Management.

Required Courses

Basic science elective ([CHE 108](#), [PHY 207/PHY 257](#), [BIO 200](#) or [BIO 201](#))

[CHE 107](#) General Chemistry for Engineers

[EAS 140](#) Engineering Solutions

[EAS 202](#) Engineering Impact on Society

[EAS 207](#) Statics

[EAS 230](#) Higher-Level Language

[EAS 305](#) Applied Probability

[IE 306](#) Statistical Methods for Engineers

[IE 320](#) Engineering Economy

[IE 323](#) Ergonomics

[IE 326](#) Planning for Production

[IE 327](#) Facilities Design

[IE 373](#) Introduction to Operations Research: Deterministic Models

[IE 374](#) Introduction to Operations Research: Probabilistic Models

[IE 408](#) Quality Assurance

[IE 420](#) Industrial and Systems Laboratory

[IE 477](#) Digital Simulation

[IE 496](#) Industrial Engineering Internship

[MGA 603](#) Financial Accounting for Managers

[MGA 605](#) Accounting for Management Decision Making

[MGB 610](#) Organizational Behavior

[MGB 611](#) Team Skills

[MGE 604](#) Business Economics

[MGF 611](#) Financial Analysis for Managers

[MGG 601](#) Corporate Social Responsibility/Sustainability

[MGG 635](#) Management Communication

[MGM 615](#) Marketing for Managers

[MGO 620](#) Operations Management

[MGO 640](#) Business Strategy

[MGO 642](#) Integration of Business Functions

[MGO 644](#) Business Practice

[MGQ 608](#) Statistical Analysis for Managers

[MGQ 609](#) Analytics for Managers

[MGS 605](#) IT Management

Seven MGT electives (may include internship)

[MTH 141](#) College Calculus I

[MTH 142](#) College Calculus II

[MTH 241](#) College Calculus III

[MTH 306](#) Introduction to Differential Equations

[MTH 309](#) Linear Algebra

[PHY 107](#) General Physics I

[PHY 108](#) General Physics II

[PHY 158](#) Physics II Lab

One engineering science elective; must be chosen from [EAS 208](#), [EAS 209](#), [EE 200](#), [EE 202](#), [MAE 204](#).

Two IE technical electives (selected from the IE department), including one from [IE 435](#) or [IE 441](#) or [IE 436](#)

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Summary

Total required credit hours for IE portion of the degree: 112

See [Baccalaureate Degree Requirements](#) for general education and remaining university requirements.

Refer to the School of Management's handbook for requirements for MBA candidates.

Recommended Sequence of Program Requirements

FIRST YEAR

Fall [CHE 107](#), [EAS 140](#), [MTH 141](#)

Spring [EAS 202](#), [MTH 142](#), [PHY 107](#), basic science elective; [IE 101](#) (optional)

SECOND YEAR

Fall [EAS 207](#), [EAS 230](#), [MTH 241](#), [PHY 108](#), [PHY 158](#)

Spring Engineering science elective; [IE 320](#), [MTH 306](#) or [MTH 309](#).

THIRD YEAR

Fall [EAS 305](#), [MTH 309](#) or [MTH 306](#), [IE 326](#), [IE 323](#)

Spring [IE 306](#), [IE 373](#), [IE 327](#), [IE 374](#)

FOURTH YEAR

Fall [IE 477](#), [MGA 603](#), [MGB 610](#), [MGB 611](#), [MGF 611](#), [MGG 601](#), [MGG 635](#), [MGM 615](#), [MGQ 608](#), [MGQ 609](#)

Spring [IE 408](#), [IE TE](#), [MGA 605](#), [MGE 604](#), [MGO 620](#), [MGO 640](#), [MGS 605](#)

FIFTH YEAR

Fall [IE 420](#), [IE TE](#), four MGT electives

Spring [IE 496](#), [MGO 642](#), [MGO 644](#), three MGT electives

Note: It may be possible to take an MBA elective to the spring semester, in order to take an IE elective in the fall semester. Students should consult with MBA and IE advisors in choosing their electives if there are any questions.

A BS diploma and an MBA diploma are awarded upon completion, with a transcript notation that these degrees were awarded as part of a combined degree program.

IE 101: Discover Industrial Engineering

Credits: 1

Semester(s): Spring

Type: LEC

Introduces students to the field of industrial engineering, and the IE department at UB, through a series of real life IE case studies and examples.

IE 306: Statistics for Engineers

Credits: 4

Semester(s): Spring

Pre-requisites: [EAS 305](#)

Industrial Engineering Majors Only

Type: LEC/REC

Principles and methodologies of statistical inference; methods of data analysis; point and interval estimation; tests of hypotheses; correlation and regression. Introduces analysis of variance methods.

IE 320: Engineering Economy

Credits: 3

Semester(s): Spring

Type: LEC

Applied concepts of economic decision making, including present worth analysis, cash-flow equivalence, replacement analysis, equipment selection. Open to students in any discipline.

IE 323: Human Factors in Sys Des

Credits: 4

Semester(s): Fall

Pre-requisites: Junior standing in engineering.

[IE 323](#)

Co-requisites: [EAS 305](#)

Approved Engineering Majors Only

Type: LEC/LAB

Focuses on the interactions of humans with tasks, equipment, and the environment as part of the workplace system. Students learn about human capabilities and limitations, applications of human factors/ergonomics principles to system design, methodologies for human-system analysis, and experimental design and data analysis applied to human factors problems.

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IE 326: Planning Prod & Serv Ent

Credits: 4

Semester(s): Fall

Pre-requisites: Junior standing in engineering
Approved Engineering Majors Only

Type: LEC/REC

Examines principles central to the planning of a production process. These include topics germane to the planning, scheduling, and control of production.

IE 327: Facility Des & Matl Handl

Credits: 3

Semester(s): Spring

Pre-requisites: [IE 326](#)

Industrial Engineering Majors Only

Type: LEC

Basics of design, analysis, and selection of manufacturing facilities and material-handling equipment. Approaches to analyzing manufacturing and material-handling systems. Applications of computers in modern facilities design and material handling, emphasizing material-flow control and storage. Economic justification models for manufacturing and material-handling systems.

IE 373: Sys Modeling & Opt: ORI

Credits: 4

Semester(s): Spring

Pre-requisites: [MTH 309](#)

Industrial Engineering Majors Only

Type: LEC/REC

Concepts of operations research methodology including objective functions, theories of value, and optimization. Elementary mathematical models of reliability, Markov decision processes, waiting-line models with Poisson arrival and exponential service, game theory, and decision analysis.

IE 374: Sys Modeling & Opt: ORII

Credits: 4

Semester(s): Spring

Pre-requisites: [EAS 305](#)

Co-requisites: [IE 373](#)

Industrial Engineering Majors Only

Type: LEC/REC

Continuation of [IE 373](#), including uncertainty, risk, and the probabilistic approach in operations research. Topics include elementary mathematical models of game theory, decision analysis, stochastic dynamic programming, stochastic processes (including Markov chains and Markov decision processes) and queues (waiting lines).

IE 406: Computer-Integrated Manufacturing

Credits: 3

Semester(s): Fall

Pre-requisites: Senior standing in IE or permission of instructor
Industrial Engineering Majors only

Type: LEC

Basic and important principles in computer-integrated manufacturing (CIM). Based on an understanding of modern production and manufacturing systems, the course further introduces to students the use of computers for the integration of all functional areas in a manufacturing enterprise. Topics include computer-aided design (CAD), geometric models and data structures, computer-aided process planning (CAPP), group technology (GT), computer-aided manufacturing (CAM), and database applications in manufacturing.

IE 408: Quality Assurance

Credits: 3

Semester(s): Spring

Pre-requisites: [IE 306](#) or equivalent

Industrial Engineering Majors Only

Type: LEC

Familiarizes students with the application of statistical quality problem-solving methodologies used to characterize, leverage, and reduce process variability. This course emphasizes the application of sampling methodologies, sample size determination, hypothesis testing, analysis of variance, correlation, regression, measurement systems analysis, design and analysis of saturated experimental designs, design and analysis response surface experimental designs, and statistical process control.

IE 409: Six Sigma Quality

Credits: 3

Semester(s): Fall

Pre-requisites: Senior standing in IE or permission of instructor
Approved Engineering Majors Only

Type: LEC

Familiarizes students with customer-focused, process and design six sigma quality management methods. This course emphasizes methodologies used in the identification and selection of high impact, customer-focused, quality improvement projects. Topics covered include leadership soft-skills, the mathematics behind six sigma metrics, project selection criterion, risk assessment, quality tools, and structured six-sigma problem-solving methodologies (DMAIC and DMADV).

IE 412: Decision Analysis

Credits: 3

Semester(s): Fall

Pre-requisites: [EAS 305](#)

Industrial Engineering Majors only

Type: LEC

Decision analysis that extends the domain of decision-making problems from those considered in traditional statistical hypothesis testing scenarios: modeling decisions, which emphasize structuring decision problems using techniques such as influence diagrams and decision trees; modeling uncertainty, which covers subjective probability assessment, use of classical probability models, Bayesian analysis, and value of information; and modeling preferences, which introduces concepts of risk preference, expected utility, and multi-attribute value and utility models.

IE 420: Systems Engineering Practicum

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Credits: 2

Semester(s): Fall

Pre-requisites: All required 300 level IE courses

[IE 420](#)

Co-requisites: [IE 477](#)

Industrial Engineering Majors only

Type: LAB

Integrates and applies knowledge from multiple aspects of industrial engineering to analyze and solve real-world ID problems. Combines knowledge of production planning, facilities design, operations research, and human factors.

IE 435: Human-Computer Interaction

Credits: 3

Semester(s): Fall, Spring

Pre-requisites: [IE 323](#) or permission of instructor

Industrial Engineering Majors only

Type: LEC

Familiarizes students with the principles and practice of use- and user-centered design of human-computer interfaces. By the end of the course, students are able to identify, describe, and implement a subset of methods appropriate for requirements gathering, user and task modeling, prototype development, and user test plan development, implementation, and analysis. Additionally, students are able to apply principles in user-centered design to interface design.

IE 436: Work Physiology

Credits: 3

Semester(s): Fall

Pre-requisites: [IE 323](#) or permission of instructor - Approved

Industrial and Biomedical Engineering Majors Only

Type: LEC

Introduces structure and functioning of the human body. Examines environmental factors such as temperature, humidity, and biological rhythms; and applications and implications of physiological measures, such as energy expenditures, heart rate, and E.M.G.

IE 441: Human Factors in Safety

Credits: 3

Semester(s): Spring

Pre-requisites: [IE 323](#) or permission of instructor

Industrial Engineering Majors Only

Type: LEC

Overall view of the professional field, particularly emphasizing the role of the human, and human factors, in safe working systems. Provides information relevant to understanding basic concepts associated with systems safety, such as the legislative environment, management culture, and sources of workplace hazards; understanding the need to consider the human when designing safe, complex systems; and analyzing a work system to predict its hazards and select possible interventions.

IE 459: Special Topics

Credits: 3

Semester(s): Fall, Spring

Pre-requisites: Senior standing in engineering

Type: LEC

The content of this course is variable and therefore it is repeatable for credit. The [University Grade Repeat Policy](#) does not apply.

Studies special areas of interest to students and instructor. Content varies from section to section and semester to semester.

IE 460: Special Topics

Credits: 3

Semester(s): Fall, Spring

Pre-requisites: Senior standing in engineering

Engineering Majors Only

Type: LEC

The content of this course is variable and therefore it is repeatable for credit. The [University Grade Repeat Policy](#) does not apply.

Studies special areas of interest to students and instructor. Content varies from section to section and semester to semester.

IE 477: SIM Mdlg & Analysis

Credits: 4

Semester(s): Fall

Pre-requisites: [IE 306](#), [IE 374](#) and computer programming skills

Industrial Engineering Majors only

Type: LEC/REC

Topics include the development of digital simulation models of complex systems using up-to-date software tools and methods.

IE 482: Robotics

Credits: 3

Semester(s): Fall, Spring

Pre-requisites: Senior standing in engineering

Type: LEC

Analyzes robots and robotic systems: kinematics, coordinate transform, numerical control, off-line programming, robot vision, and simulation of robotic systems.

IE 496: Senior Capstone Internship

Credits: 1

Semester(s): Spring

Type: LEC

A field experience working on an industrial engineering project in a manufacturing plant, hospital, library, police department, or similar location under the joint direction of a preceptor from industry and a faculty advisor. Projects are selected that integrate the material learned in academic courses. Requires a written report and an oral presentation.

IE 498: Undergraduate Research

Credits: 1-3

Semester(s): Fall, Spring, Summer

Pre-requisites: Permission of instructor

Engineering Majors Only

Type: TUT

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The content of this course is variable and therefore it is repeatable for credit. The [University Grade Repeat Policy](#) does not apply.

Students collaborate with faculty research mentors on ongoing research of the faculty member or conduct independent research under the guidance of a faculty member.

IE 499: Independent Study

Credits: 1-12

Semester(s): Fall, Spring, Summer

Pre-requisites: Permission of instructor

Industrial Engineering Majors Only

Type: TUT

The content of this course is variable and therefore it is repeatable for credit. The [University Grade Repeat Policy](#) does not apply.

Student directed independent learning activity guided & mentored by faculty. Students should discuss registration with the faculty member and have a plan in writing upon registering. Note that activities that are primarily research (vs. study or project based) should be conducted under the [IE 498](#) number.