Industrial Engineering

James S. Noble, Chair
College of Engineering
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https://engineering.missouri.edu/ise (https://engineering.missouri.edu/ise/)

Industrial and Systems Engineering builds on a foundation of science, mathematics, computing and data analytics in order to address a wide range of issues in the socio-technical system (complex combinations of people and technology) and environmental (sustainability) domains. With this unique blend of skills, industrial engineering bring optimization-based approaches to a variety of problems in manufacturing, healthcare, supply chain/logistics, sustainability and service organizations.

Industrial engineers in manufacturing organizations address many issues including designing workplaces, considering both the capabilities of machines and humans. They may design computer-integrated manufacturing systems that include automation and robotics. They may also control production, optimize inventory, design quality systems, evaluate new product proposals and build new or improved production facilities.

Industrial engineers working in the supply chain/logistics domain address issues ranging from supplier selection, demand forecasting, inventory systems, facility location, distribution network design, and transportation.

Industrial engineers are also involved in sustainable systems design where they seek to minimize environmental impact while cost-effectively delivering the goods and services demanded by humanity. Issues addressed range from optimizing the environmental performance of an individual product to quantitatively assessing the performance of energy systems.

Industrial engineering skills are used to design better healthcare delivery where they increase the efficiency of the healthcare system. They also work to reduce errors in a wide range of human-centered systems with expertise from data-driven science and ergonomics.

Finally, industrial engineering skills can help facilitate the judicial process, provide faster and more accurate mail distribution, and optimize airline routing and reservation methods. In summary, the industrial engineer may be involved in the design and operation of a range of systems that provide services at a cost that society can afford at the quality that is required.

The MU ISE department offers a Bachelor of Science degree with a major in Industrial Engineering (BSIE), an accelerated Industrial Engineering BSIE/MSIE and a five-year BSIE/MBA program. At the graduate level, the department offers the Master of Science in Industrial Engineering (MSIE) and the Doctor of Philosophy in Industrial Engineering (PhD IE) degrees. The department also offers students the opportunity to obtain Lean Six Sigma Green Belt certification and/or an interdisciplinary Global Supply Chain Management certification.

Faculty

Professor J. S. Noble**
Associate Professor J. H. Kim**, S. Rajendran**, S. Srinivas**
Assistant Professor C. Dou*, H. Na*, Y. Wang**
Associate Teaching Professor O. Shahvari*
Assistant Teaching Professor D. Emre*
Associate Professor Emeritus L. Occeña

* Graduate Faculty Member - membership is required to teach graduate-level courses, chair master's thesis committees, and serve on doctoral examination and dissertation committees.
** Doctoral Faculty Member - membership is required to chair doctoral examination or dissertation committees. Graduate faculty membership is a prerequisite for Doctoral faculty membership.

Undergraduate

- BSIE in Industrial Engineering (https://catalog.missouri.edu/collegeofengineering/industrialengineering/bsie-industrial-engineering/)

Advising Contact
Engineering Advising Office
Phone: 573-884-6961
Email: muengradvising@missouri.edu
Website: https://engineering.missouri.edu/student-services/advising/

Suchi Rajendran, Director of Undergraduate Studies

Scholarship Information Contact
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Industrial engineering undergraduates complete a core engineering curriculum during the first two years. The objective of this curriculum is to give the student a rigorous foundation in mathematics, natural sciences, basic engineering sciences, applied probability, and computer science, as well as a complementary and meaningful exposure to the humanities and social sciences.

Building on the core courses, students gain knowledge of optimization methodologies, human factors, data analytics and systems modeling. They also learn to model and evaluate integrated systems of people, technology and information in the areas of production and service system design, supply chain design and management, control systems, quality systems, sustainability, data engineering, product and process design.

These fundamental skills provide the foundation from which students learn to develop systematic, integrated, and optimal solution approaches to large-scale enterprise problems. In order to be successful as they begin their careers (or graduate study) students learn to communicate effectively in both oral and written forms, and become proficient in working in diverse teams of individuals. Lastly, the curriculum introduces the student to ethical and professional issues in engineering practice.

Industrial engineering design experiences are integrated throughout the curriculum, most often in a team-based environment. Industrial engineering design is the process of developing and improving integrated systems that include people, materials, information, equipment and energy.

Admission Requirements

- Students pursuing a BS in Industrial Engineering must meet MU's General Admission Standard to be considered a Direct Program Admit.

Program Educational Objectives

The IE Program educational objectives have been developed to address the needs of our constituencies and to be consistent with the University of Missouri mission. Within 3-5 years of graduation from the industrial engineering program in the Industrial and Manufacturing Systems Engineering Department at the University of Missouri:

- Graduates will create value for their employers, demonstrating entrepreneurial initiative, and make contributions that benefit society.
- Graduates will expand their capabilities through professional development and advanced education.
- Graduates will provide leadership and be agents of change in their profession and/or communities.

The objectives are based on a few key concepts: value, entrepreneurial initiative, expanding capability, leadership, and being agents of change. "Value" creation is defined as what a graduate's employer requires in order to achieve its stated objectives. The ISE graduate adds value to the organization by taking entrepreneurial initiative that contributes to the greater good of society. Graduates face an environment where technology is advancing at an ever increasing pace, therefore, they will need to expand their knowledge and capabilities through professional development and advanced education. Due to their systems view of the enterprise, industrial engineers are often called upon to provide leadership within an enterprise and, as such, are required to manage the change that is inherent in today's dynamic environment.

Student Outcomes

Student Outcomes (SO) are defined as the abilities the department's BSIE graduates will have upon graduation that will enable them to achieve the program's educational objectives. The student objectives reflect the assimilation of what has been taught in the curriculum upon completion of the undergraduate education.

All MU BSIE graduates should have:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

In summary, graduates of the Department of Industrial and Systems Engineering (ISE) will possess a strong foundation upon which they can grow professionally, and continue to build a focused set of fundamental and engineering knowledge and skills that are integrated and applicable to real-world problems in any enterprise setting.

ISE Honors Program

The ISE Honors Program follows the regulations and philosophy of the College of Engineering Honors Program, and as such is intended to encourage, facilitate and reward independent study by high-ability undergraduate students.

The heart of the program is an undergraduate honors project, undertaken and completed by the time of graduation while enrolling in 3 to 6 credits of ISE 4995 Undergraduate Research Industrial Engineering - Honors. The academic credit for the honors project (3-6 credits in ISE 4995 replaces an equivalent number of credits of ISE or Technical electives. The project is conducted under the direction of an ISE professor (honors advisor) who is selected by the student, with agreement by the professor. The project culminates in an honors thesis, which is read and approved by the honors advisor and a second reader. A finished copy of the honors thesis, signed by the honors advisor and second reader, is required for satisfactory completion of the project.

Academic Qualifications for the Honors Program
Honors students must maintain and graduate with a 3.0 overall GPA. In the case of a transfer student, their transferred credit plus their MU credit will average 3.0/4.0. Students must have a minimum of 60 credit hours.

The successful honors scholar has a degree of flexibility in their program of study. Honors scholars may reduce the credits required for degree completion to the University minimum (i.e., 120 credits) by substituting graduate course credits through dual enrollment (undergraduate/graduate at MU) during the last two semesters of the undergraduate program. Any 8000 level course may be substituted, but only courses at the 7000 level that are not required for the BSIE degree at the 4000 level (eg. ISE elective courses, technical electives) may be substituted.

Lean Six Sigma Green Belt Certification

ISE students have the opportunity to obtain a Lean Six Sigma Green Belt certification either during their degree program or after. Certification requires students to obtain a GPA average of 2.5 or better in ISE 4110, ISE 4310, and ISE 4610, then they must successfully complete ISE 4385-Lean Six Sigma Green Belt Project (a 1 credit hour course where DMAIC is used to improve a process within an organization).

Global Supply Chain Management Certificate

ISE students have the opportunity to obtain an interdisciplinary undergraduate Certificate in Global Supply Chain Management (GSCM) which is jointly offered by the Department of Management and the Department of Industrial and Systems Engineering. Certification requires students to complete 15 credit hours with a 3.0 GPA. There are nine required credit hours (MANGMT 4070, ISE 4350 and ISE 4910), plus six elective hours from a list of courses.

Graduate

- MS in Industrial Engineering (https://catalog.missouri.edu/collegeofengineering/industrialengineering/ms-industrial-engineering/)
- PhD in Industrial Engineering (https://catalog.missouri.edu/collegeofengineering/industrialengineering/phd-industrial-engineering/)

Industrial & Systems Engineering Graduate Programs

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Director of Graduate Studies: Sharan Srinivas

About ISE

The graduate program in industrial engineering provides a scholarly environment in which highly qualified, creative students may obtain the knowledge and develop the skills necessary to solve complex industrial, governmental and societal system design problems. These systems are required to operate within increasingly complex constraints, thus requiring the use of sophisticated and creative designs. The industrial engineer responsible for such designs must be capable of applying a broad spectrum of scientific tools if the most effective systems are to be obtained.

Our master of science program is designed to provide a basic understanding of these tools and experience in the application of these tools in the design process. The doctor of philosophy program is designed to provide the specialized knowledge and skills necessary to develop new tools or methods for solving complex systems design problems. Graduate students are able to obtain an interdisciplinary Global Supply Chain Management certificate as part of their academic program.

General Admission Guidelines

Acceptance for advisement in the department's graduate programs is available to students with an ABET accredited undergraduate engineering degree. Students with baccalaureate degrees in mathematics, physics, chemistry or computer science may be accepted if they have completed 13 hours of calculus, and six hours of calculus-based probability and statistics. Several factors are considered in evaluating an applicant's capability, such as overall GPA, grade trends and major area grades. In addition, each applicant is encouraged to take the general test of the GRE and international students must take the TOEFL or IELTS.

Facilities and Resources

Laboratory facilities in several major application areas, both within the department and in the college, support the academic program. Neighboring industries, city, county and state government agencies, local hospitals and nearby large metropolitan centers provide a reservoir of research and design opportunities.

Computing and Reference Materials

The department has access to the University of Missouri System computing network and maintains its own computing facilities for student use. Besides Ellis Library facilities, an excellent collection of mathematical, statistical and engineering books and reference materials are housed in the Engineering Library.

Funding

Fellowships, scholarships and teaching and research assistantships are available to qualified graduate students. These forms of financial assistance are supported by funds made available through state, federal and industrial graduate support programs and through research grants from various industrial and governmental agencies.