DEPARTMENT OF INDUSTRIAL AND SYSTEMS ENGINEERING

Industrial engineering is an engineering discipline devoted to the design, installation, improvement and control of integrated systems of people, materials, and facilities in a wide range of organizations that produce goods or render services. Like other engineering fields, industrial engineering is concerned with solving problems through the application of specialized knowledge in mathematics and science, as well as the principles of engineering. An important characteristic of industrial engineering is its systems approach to integrate the basic resources of production and service systems and other relevant resources, such as information and energy, in such a way as to create a smooth, efficient and competitive operation within an enterprise. Industrial and systems engineers are needed in virtually all types of enterprises, ranging from industries such as manufacturing, distribution, logistics, transportation, and construction; service sectors such as health care, telecommunications, retail, banking, and engineering consulting to government agencies, military, and non-profit organizations.

The mission of the Industrial Engineering program is to serve the state, nation, and global community by educating industrial engineering students to be well founded in engineering fundamentals and to have the knowledge and skills required to design, develop, improve, implement and control sophisticated production and service systems in an environment characterized by complex technical and social challenges. Throughout this educational process, students will be instilled with the highest standards of professional and ethical behavior. It is the intent of the undergraduate industrial engineering program to equip its graduates to achieve the following accomplishments a few years after graduation:

1. Graduates will be successful in improving operations by solving complex industrial engineering problems.
2. Graduates will demonstrate professional leadership.
3. Graduates will be instilled with the motivation and ability to accomplish professional life-long learning.

The undergraduate program in Industrial Engineering at Texas A&M University is accredited by the Engineering Accreditation Commission of ABET, www.abet.org.

Industrial Engineering students may participate in the Undergraduate Minor Program offered by Texas A&M. This program is usually comprised of 15 to 18 hours, some of which may be substituted as technical electives. The most common minors are math, business and economics. The department also has a Fast Track Program for academically qualified students who want to take selected graduate courses and receive both graduate and undergraduate credit by meeting specific requirements. The department encourages students to participate in industrial internships or the Cooperative Education Program to acquire practical experience to complement their industrial engineering education. Internships are generally encouraged during the summer months only. Students who participate in the Co-op program during three academic semesters may count the three credit hours as a technical elective in their curriculum.

Graduate degrees including the Master of Science (MS), Master of Engineering (M.Eng.), and Doctor of Philosophy (PhD) are also offered by the department in addition to the Bachelor of Science in Industrial Engineering. For graduate degree information, please see the Texas A&M University Graduate Catalog.

Before commencing course work in the major, students must be admitted to the major or have the approval of the department.

Faculty

Banerjee, Amarnath P, Professor
Industrial & Systems Eng
PHD, University of Illinois at Chicago, 1999

Bennett, George K, Senior Professor
Industrial & Systems Eng
PHD, Texas Tech University, 1970

Bukkapatnam, Satish T, Professor
Industrial & Systems Eng
PHD, The Pennsylvania State University, 1997

Butenko, Sergiy I, Professor
Industrial & Systems Eng
PHD, University of Florida, 2003

Curry, Guy L, Senior Professor
Industrial & Systems Eng
PHD, University of Arkansas, 1971

Ding, Yu, Professor
Industrial & Systems Eng
PHD, University of Michigan, 2001

Elwany, Alaa Mohamed H, Assistant Professor
Industrial & Systems Eng
PHD, Georgia Institute of Technology, 2009

Erraguntla, Madhav, Associate Professor of the Practice
Industrial & Systems Eng
PHD, Texas A&M University, 1996

Feldman, Richard M, Senior Professor
Industrial & Systems Eng
PHD, Northwestern University, 1975

Ferris, Thomas K, Associate Professor
Industrial & Systems Eng
PHD, University of Michigan, 2010

Gautam, Natarajan, Professor
Industrial & Systems Eng
PHD, University of North Carolina at Chapel Hill, 1997

Graul, Michael H, Associate Professor of the Practice
Industrial & Systems Eng
PHD, Texas A&M University, 1995

Johnson, Andrew L, Associate Professor
Industrial & Systems Eng
PHD, Georgia Institute of Technology, 2006

Kianfar, Kiavash, Associate Professor
Industrial & Systems Eng
PHD, North Carolina State University, 2007

Mayer, Richard J, Adjunct Professor
Industrial & Systems Eng
PHD, Texas A&M University, 1998
Certificates

• Data Center Operations Engineering Certificate (http://catalog.tamu.edu/undergraduate/engineering/industrial-systems/data-center-operations-certificate)
• Engineering Systems Management Certificate (http://catalog.tamu.edu/undergraduate/engineering/industrial-systems/engineering-systems-management-certificate)

Courses

ISEN 101 Introduction to Industrial Engineering
Credit 1. 1 Lecture Hour.
Introduction to industrial engineering; overview of the curriculum; presentations by faculty and industry to familiarize with the department and the scope of industrial engineering applications.

ISEN 210 Fundamentals of Industrial Engineering Design
Credits 4. 3 Lecture Hours. 3 Lab Hours.
Engineering design for product development, problem definition and need identification, information gathering and concept generation, decision making and concept selection; industrial engineering concepts including design for manufacturing, assembly, sustainability and environment; economic decision making and cost evaluation; risk, reliability and safety; quality; robust design and optimization.
Prerequisite: ENGR 112.

ISEN 230 Informatics for Industrial Engineers
Credits 3. 3 Lecture Hours.
Structured programming concepts for implementing mathematical and statistical models in industrial engineering problems; emphasis on introductory production and service system problems and computer-based approaches to solve the problems; engineering applications of probability and statistics concepts.
Prerequisite: CSCE 206 or CSCE 111 or CSCE 121 or equivalent. Concurrent enrollment in STAT 211.

ISEN 285 Directed Studies
Credits 1 to 4. 1 to 4 Other Hours.
Problems of limited scope in industrial engineering approved on an individual basis intended to promote independent study.
Prerequisite: Approval of department head.

ISEN 291 Research
Credits 1 to 4. 1 to 4 Other Hours.
Research conducted under the direction of faculty member in industrial and systems engineering. May be taken four times for credit.
Prerequisites: Freshman or sophomore classification and approval of instructor.

ISEN 302 Economic Analysis of Engineering Projects
Credits 2. 2 Lecture Hours.
Principles of economic equivalence; time value of money; analysis of single and multiple investments; comparison of alternatives; capital recovery and after-tax analysis of economic projects.
Prerequisite: MATH 152.

ISEN 303 Engineering Economic Analysis
Credits 3. 3 Lecture Hours.
Principles of economic equivalence; time value of money; analysis of single and multiple investments; comparison of alternatives; capital recovery and tax implications; certainty; uncertainty; risk analysis; public sector analysis and break-even concepts.
Prerequisite: MATH 152.
ISEN 310 Uncertainty Modeling for Industrial Engineering
Credits 3. 3 Lecture Hours.
Models and methods based on probability and statistics for industrial engineering applications; random variables, expectation, distribution fitting, reliability of systems, central limit theorem and interval estimates in the context of production and service systems.
Prerequisites: ISEN 230 and STAT 211; junior or senior classification.

ISEN 320 Operations Research I
Credits 3. 3 Lecture Hours.
Development and application of fundamental deterministic optimization models and solution methods; focus on quantitative modeling and formulation of linear, integer, and network flow problems; use of computer optimization software to model and solve real-life problems.
Prerequisites: MATH 304; junior or senior classification.

ISEN 330 Human Systems Interaction
Credits 3. 3 Lecture Hours.
Principles of human factors and ergonomics; emphasis on design to support human capabilities, limitations, and interaction tendencies in sociotechnical work systems; topics include human information processing, physiological and biomechanical functioning, and implications for design of the workplace and jobs; case studies in manufacturing, medicine, aerospace, ground transportation, and computer interaction.
Prerequisites: MMET 181; junior classification.

ISEN 340 Operations Research II
Credits 3. 3 Lecture Hours.
Probabilistic methods for industrial and service systems; stochastic processes used in industrial engineering, including Poisson processes and discrete and continuous-time Markov chains; applications to production operations, inventory control, revenue management, quality control, reliability, digital simulation and finance.
Prerequisites: MATH 304 and ISEN 310; junior or senior classification.

ISEN 350 Quality Engineering
Credits 3. 2 Lecture Hours. 3 Lab Hours.
Strategic approach to implementing quality, process and business improvement methods using data analysis tools; total quality management and six sigma approaches to define, measure, analyze, improve and control processes; principles of lean engineering; control charts; process capability analysis; basic metrology, applied statistics, lean principles and process capability.
Prerequisites: ISEN 310 and ISEN 230; junior or senior classification.

ISEN 355 System Simulation
Credits 3. 2 Lecture Hours. 3 Lab Hours.
Systems simulation structure, logic and methodologies; development of simulation models; data handling methods; analysis of simulation data; verification and validation; system simulation languages, models and analysis; applications to industrial situations.
Prerequisites: ISEN 230 and ISEN 310; junior or senior classification.

ISEN 360 Lean Thinking and Lean Engineering in the Process Industries
Credits 3. 3 Lecture Hours.
Philosophical, managerial, and operational principles of lean thinking within the context, tools, and practices of lean engineering; emphasis on the pharmaceutical and process industry; design of lean systems, lean cell design, modeling of lean manufacturing systems, and operation of manufacturing cells; queuing network theory for the analysis of lean systems.
Prerequisites: STAT 211; junior or senior classification for students other than INEN majors.

ISEN 370 Production Systems Engineering
Credits 3. 3 Lecture Hours.
Principles, models, and techniques for planning and analysis of production and distribution systems; application of linear, integer, and nonlinear optimization models and solution methods for aggregate planning, supply chain planning, push (MRP) and pull (JIT) material flow management, inventory control under deterministic and stochastic demands, operations scheduling, and production scheduling.
Prerequisites: ISEN 230 and ISEN 320; junior or senior classification.

ISEN 399 Professional Development
Credits 0. 0 Other Hours.
Participation in an approved high-impact learning practice; reflection on professional outcomes from engineering body of knowledge; documentation and self-assessment of learning experience at mid-curriculum point.
Prerequisites: ISEN 210 and ISEN 230; junior or senior classification or approval of instructor.

ISEN 405 Facilities Design and Material Handling
Credits 3. 3 Lecture Hours.
Principles of facilities location, layout, and material handling systems and to practice designing facilities; modeling, design, and analysis techniques; methodologies in facilities location, layout, and material handling; integration of ergonomics analysis techniques and their implications on design, layout, safety and quality.
Prerequisites: ISEN 210 and ISEN 320; junior or senior classification.

ISEN 408 Supply Chain and Logistics
Credits 3. 3 Lecture Hours.
Principles, models and techniques for planning, analysis and design of supply chain systems; optimization principles, including linear and integer programming, applied to supply chain planning and operations; information technology, design models, databases, and strategic and tactical decision making.
Prerequisites: ISEN 320, ISEN 340, and ISEN 370; junior or senior classification.

ISEN 410 Advanced Engineering Economy
Credits 3. 3 Lecture Hours.
Principles of economic equivalence; borrowing, lending, and investing; establishing minimum attractive rate of return; replacement analysis; capital budgeting; uncertainty analysis; decision trees.
Prerequisites: ISEN 210 or ISEN 302; junior or senior classification.

ISEN 411 Engineering Management Techniques
Credits 3. 3 Lecture Hours.
Techniques relating to managing engineering activities; engineer’s transition into management; engineering managerial functions; motivation of individual and group behavior; productivity assessment/ improvement; managing the quality function and communications.
Prerequisite: Senior classification in industrial engineering.

ISEN 413 Advanced Data Analytics for Industry
Credits 3. 3 Lecture Hours.
Data mining; linear discriminant analysis (LDA), principal component analysis (PCA) and other methods; classification, clustering, and mining, information extraction; dealing with uncertainty, Bayesian inference; neural models, regression and feature selection.
Prerequisites: ISEN 310 and ISEN 350; junior or senior classification.
ISEN 414 Total Quality Engineering  
Credits 3. 2 Lecture Hours. 3 Lab Hours.  
Principles of total quality engineering; total quality management philosophy, engineering approaches for designing quality into products and processes; off-line experimentation methods for the robust design; emphasis on teamwork and continuous quality improvement.  
**Prerequisite:** STAT 211; junior or senior classification.

ISEN 416 Facilities Location, Layout and Material Handling  
Credits 4. 3 Lecture Hours. 3 Lab Hours.  
Analytical treatment of facilities location, physical layout, material flow and handling, combined with heuristic algorithms to assist in the design of production/service facilities; fundamental concepts applied through a sequence of design projects.  
**Prerequisites:** ISEN 315; ISEN 316 or registration therein.

ISEN 425 Design and Analysis of Industrial Systems with Simulation  
Credits 3. 2 Lecture Hours. 3 Lab Hours.  
In-depth study into the design-modeling and subsequent analysis of contemporary production/service systems; factory/service systems are modeled using the ARENA/SIMAN V simulation-animation language; emphasis is placed on the critical analysis of alternative flow designs of modeled systems using flow and economic parameters to assess system improvement.  
**Prerequisites:** ISEN 303 and ISEN 424.

ISEN 434 Human Error and System Failures  
Credits 3. 3 Lecture Hours.  
Human error from a sociotechnical systems perspective; role of error in complex system failures; human behavioral modes and system design factors; analytical methods for defining the roles and impact of errors in large-scale system accidents; real-world case studies.  
**Prerequisites:** ISEN 330; junior or senior classification.

ISEN 440 Systems Thinking  
Credits 3. 3 Lecture Hours.  
Systems thinking process, systems of systems and the fundamental considerations associated with the engineering of large-scale systems, or systems engineering including systems modeling, design and the system development process.  
**Prerequisites:** MATH 304 or approval of instructor; junior or senior classification.

ISEN 442 Organizational Systems  
Credits 3. 3 Lecture Hours.  
Role of people and organizations in the design and development of complex engineered systems; providing engineers with the skills needed to effectively manage large-scale system development programs.  
**Prerequisites:** ISEN 330; junior or senior classification.

ISEN 450 Healthcare Systems Engineering  
Credits 3. 3 Lecture Hours.  
Explores components of healthcare system, existing problems in healthcare systems; need for engineering to analyze healthcare system problems; application of industrial engineering tools in improving healthcare system; role of industrial engineering in addressing healthcare policy issues.  
**Prerequisites:** ISEN 314, ISEN 420, ISEN 424, or approval of instructor; junior or senior classification.

ISEN 453 Manufacturing Operations  
Credits 3. 3 Lecture Hours.  
Analytical principles of manufacturing systems design, analysis and control; emphasis placed on stochastic analysis; role of variability and impact on cycle time; push versus pull production strategies including Kanban and constant WIP control; probability, queuing theory, Little’s Law, heavy traffic approximations, and queuing networks.  
**Prerequisites:** ISEN 340; junior or senior classification.

ISEN 460 Capstone Senior Design  
Credits 3. 1 Lecture Hour. 6 Lab Hours.  
Engineering design including identification of a problem; development, analysis and evaluation of alternative solutions; and recommendations for and, where possible, development of systems improvement tools; application of experience and training to provide a product or solution that helps company clients; balancing client needs with academic requirements.  
**Prerequisite:** ISEN 340, ISEN 350, ISEN 355 and ISEN 370; junior or senior classification.

ISEN 485 Directed Studies  
Credits 1 to 6. 1 to 6 Other Hours.  
Permits work on special project in industrial engineering. Project must be approved by department head.  
**Prerequisite:** Senior classification in industrial engineering.

ISEN 489 Special Topics in...  
Credits 1 to 5. 1 to 5 Lecture Hours. 0 to 5 Lab Hours.  
In-depth study of areas of current student interest and recent advances; normally used for first time offering of new courses.  
**Prerequisite:** Approval of instructor.

ISEN 491 Research  
Credits 1 to 4. 1 to 4 Other Hours.  
Research conducted under the direction of faculty member in industrial and systems engineering. May be taken three times for credit.  
**Prerequisites:** Junior or senior classification and approval of instructor.