INDUSTRIAL ENGINEERING

Undergraduate Program Information

Industrial engineers design, develop, install and improve integrated systems. This could be for people, equipment, information, financial resources, software, materials or energy. Industrial engineers work in a variety of manufacturing, health care, utility, retail, government and research settings, therefore the tools and methods of the industrial engineer are both varied and broad. They use knowledge and skills in engineering, mathematics, and physical and social sciences. Industrial engineers also use principles and methods of engineering analysis and design to monitor and improve such systems. New Mexico State University’s undergraduate degree program in Industrial Engineering prepares students to join the work force or pursue graduate education while setting the foundation for life-long learning.

Specifically, graduates of the program will be:

- able to apply various industrial engineering techniques in an integrated fashion to solve real world problems in process design and/or improvement;
- able to obtain meaningful employment or enroll in a graduate program; and
- prepared for a long-term, successful career sustained by life-long learning experiences

In addition, the Engineering Accreditation Commission of ABET, Inc. criteria in conjunction with the Institute of Industrial Engineers, requires that:

- baccalaureate degree graduates will be able to demonstrate the ability to design, develop, implement and improve integrated systems that include people, materials, information, equipment and energy;
- industrial engineering curriculums include in-depth instruction allowing students to accomplish the integration of systems using appropriate analytical, computational and experimental practices; and
- that faculty teaching in industrial engineering departments show evidence of understanding professional practice and maintain currency in their respective professional areas. Program faculty must have responsibility and sufficient authority to define, revise, implement and achieve program objectives.

Graduate Program Information

The Department of Industrial Engineering offers graduate work leading to the degrees of Master of Science in Industrial Engineering and Doctor of Philosophy with specialization in industrial engineering. Areas of emphasis include

- computer modeling,
- operations research and systems engineering,
- manufacturing systems,
- quality and reliability engineering.

Departmental admission requirements in addition to those of the Graduate School must be considered on an individual basis because of the diversity of backgrounds of applicants in the program. An applicant should meet or correspond directly with the department as a first step in determining his or her specific admission status. Applicants should present mathematics preparation equivalent to 9 credits of calculus for engineers, 3 credits of differential equations, and 3 credits of calculus-based probability and statistics.

Minimum credit-hour requirements for the master's degree may be met in any of the following ways:

1. 24 semester credits approved course work and 6 semester credits of thesis (I E 599 Master’s Thesis) for a total of 30 semester credits,
2. 27 semester credits approved course work and 3 semester credits of project (I E 598 Special Research Programs) for a total of 30 semester credits, or
3. 30 semester credits of approved course work.

Approved course work must meet all requirements of the Graduate School, represent a consistent master’s program in relation to a student’s graduate study goals as determined through consultation with the graduate program adviser, and be approved by a program committee of the graduate faculty of the department. Programs in the focus areas of engineering management, computer modeling, operations research or manufacturing engineering can be developed with the aid of a faculty advisor.

Departmental facilities and equipment are available to support research efforts of graduate students, including computer terminals and laboratories. In addition to departmental facilities, supporting facilities such as the Manufacturing Technology and Engineering Center and five interdisciplinary Research Clusters are available for research work.

The Ph.D. program is research oriented with the final product being the dissertation. The general information (http://catalogs.nmsu.edu/nmsu/regulations-policies) chapter in this catalog describes the Ph.D. The program in industrial engineering also includes the following additions:

- the course work must include at least 12 credits at the 500 level in a related field,
- 6 credits of 600-level research courses covering two areas, and
- 18 credits of 700-level courses following successful completion of the comprehensive examination.

The department does not have any foreign language or research tool requirements. Interested individuals should correspond directly with the department to determine eligibility for admission.

Degrees for the Department

Industrial Engineering - Bachelor of Science in Industrial Engineering (http://catalogs.nmsu.edu/nmsu/engineering/industrial-engineering/industrial-engineering-bachelor-science-industrial-engineering)

Industrial Engineering - Master of Science in Industrial Engineering (http://catalogs.nmsu.edu/nmsu/engineering/industrial-engineering/industrial-engineering-master-science-industrial-engineering)

Engineering - Doctor of Philosophy (http://catalogs.nmsu.edu/nmsu/engineering/industrial-engineering/engineering-doctor-philosophy)

Minors for the Department

Entrepreneurship - Undergraduate Minor (http://catalogs.nmsu.edu/nmsu/engineering/industrial-engineering/entrepreneurship-undergraduate-minor)

Associate Professor, Edward Pines, Department Head
**Associate Professors** Mullen, Pines, Sohn, Valles-Rosales; **Assistant Professors** Kammerdiner, Razzaghi

E. Pines, Department Head, Ph.D. (Penn State)—quality and continuous improvement, technology policy; H. Sohn, Ph.D. (University of Iowa)—operations research, discrete optimization, network design; J. Mullen, Ph.D. (Iowa State)—stochastic processes, quality, improvement, production system design; D. J. Valles-Rosales, Ph.D. (New Mexico State)—manufacturing systems, soft computing technologies, computer integrated manufacturing; A. Kammerdiner, Ph.D. (University of Florida)—statistical analysis, data mining, network science and combinatorial optimization; T. Razzaghi, PhD (Central Florida) Data modeling, health care systems engineering

**I E 110. Industrial Engineering Orientation**
1 Credit
Introduction to Industrial Engineering Department, Facility Research and Resources. Overview of where industrial engineering fits into larger view of all of engineering. Introduction to university resources for industrial engineering students. Restricted to majors.

**I E 151. Computational Methods in Industrial Engineering**
3 Credits
History, social implications, and application of computers and an introduction to computer programming, word processing, and database management systems. Satisfies General Education computer science requirement.  
Prerequisite: MATH 121G.

**I E 152. Introduction to Industrial Engineering**
2 Credits
Historical development of industrial engineering, present practice and trends.  
Prerequisite: MATH 120.

**I E 200. Special Problems-Sophomore**
1-3 Credits
Directed individual projects. May be repeated for a total of 3 credits.  
Prerequisite: consent of faculty member.

**I E 217. Manufacturing Processes**
2 Credits
Manufacturing methods and industrial processes which include casting, forming and machining. Crosslisted with: E T 217  
**Prerequisite(s):** MATH 121G.  
**Corequisite(s):** I E 217L.

**I E 217 L. Manufacturing Processes Laboratory**
1 Credit
Laboratory associated with I E 217.

**I E 300. Special Problems-Junior**
1-3 Credits
Directed individual projects. May be repeated for a total of 3 credits.  
Prerequisite: consent of faculty member.

**I E 311. Engineering Data Analysis**
3 Credits
Methodology and techniques associated with identifying and analyzing industrial data. May be repeated up to 3 credits. C- or better in I E 151, C S 110, or equivalent.  
**Prerequisite(s):** C- or better in MATH 192G.

**I E 316. Methods Engineering**
3 Credits (2+3P)
Methods analysis and design. Work measurement techniques. Job evaluation and wage incentive methods.  
**Prerequisite:** I E 311.

**I E 330. Environmental Management Seminar I**
1 Credit
Survey of practical and new developments in hazardous and radioactive waste management provided through a series of guest lectures and reports of ongoing research. Restricted to: Main campus only. Crosslisted with: C E 330, CH E 330, E E 330, E S 330, E T 330, M E 330 and WERC 330

**I E 351. Applied Problem Solving in Industrial Engineering**
3 Credits
Application of computational techniques to engineering problems including the use of commercial programs in statistics and applied mathematics. Restricted to majors.  
**Corequisite:** I E 311.

**I E 365. Quality Control**
3 Credits
Statistical analysis of quality in manufacturing. Acceptance sampling and control charts.  
**Prerequisite:** I E 311 or equivalent.

**I E 375. Manufacturing Processes II**
3 Credits
Review of basic manufacturing processes. Advanced topics in casting, forming, machining and joining; major process parameters; economics of processes.  
**Prerequisite:** I E 217 or E T 217.

**I E 381. Technology Ventures**
3 Credits
This course looks at how new technology ventures are formed at the individual entrepreneur and corporate levels. It covers the development of science and engineering based ventures from ideas through creating customer value. This is the first course in the Entrepreneurship Minor. The roles of science and engineering specialists in the creation of customer value are defined in preparation for development of technology-based enterprises.

**I E 382. Business for the Practicing Engineer**
3 Credits
Business tools and skills, including technology commercialization, patent applications, preparing a technology-oriented business plan, reading and constructing financial documents, modeling and understanding markets, e-commerce, QFD, concurrent engineering, engineer’s role in the global economy, and engineer’s impact on product design and cost.  
**Prerequisite:** engineering major, junior level or above.

**I E 400. Undergraduate Research**
1-3 Credits
May be repeated for a maximum of 6 credits.  
**Prerequisite:** consent of faculty member.

**I E 411. Occupational Safety**
3 Credits
Practical methods to improve safety in the workplace. Topics include OSHA and other regulations, hazard recognition, assessment and control, industry standards, risk assessment and safety management. Material is applicable to a variety of workplace settings. This course is intended for College of Engineering students who have completed their lower-division requirements in mathematics, engineering, technology, and basic science. Same as I E 561 with differential assignments.  
**Prerequisite:** Junior standing.
I E 413. Engineering Operations Research I  
3 Credits  
Deterministic operations research modeling including linear and integer programming.  
Prerequisite: MATH 192G.

I E 423. Engineering Operations Research II  
3 Credits  
Probabilistic operations research modeling, including queuing systems and their optimization; Markov chains.  
Prerequisite: I E 311.

I E 424. Manufacturing Systems  
3 Credits  
Organization and functions of manufacturing planning and control systems including forecasting, MRP, capacity planning, JIT systems, scheduling, and inventory control.  
Prerequisite: I E 311.

I E 451. Engineering Economy  
3 Credits  
Discounted cash flows, economics of project, contract and specifications as related to engineering design. Same as CH E 451.

I E 453. Leadership and Motivation  
3 Credits  
Theories of leadership and motivation. Motivational programs for complex organizations. Relationships between organizational power, authority, and management styles. Same as MGT 453.  
Prerequisite: MGT 309 or consent of instructor.

I E 460. Evaluation of Engineering Data  
3 Credits  
Analysis of engineering systems possessing variability, employing regression, analysis of variance, distribution theory, and experimental design methods.  
Prerequisite: I E 311 or equivalent.

I E 466. Reliability  
3 Credits  
Application of statistical theory to engineering reliability estimation, reliability improvement, and the analysis of reliability test data.  
Prerequisite: I E 311 or equivalent.

I E 467. Discrete-Event Simulation Modeling  
4 Credits  
Basic modeling concepts, organizations of simulations, input data analysis, random variate generation, simulation design and analysis, model validation, output analysis, and management of simulations. Differentiated graduate assignments. Same as I E 567.  
Prerequisite: I E 311 or equivalent.

I E 478. Facilities Planning and Design  
3 Credits  
Plant location methods, total process analysis, process integration, materials handling analysis, and traditional and computerized plant layout methodologies. Pre/  
Prerequisite: I E 316.  
Corequisite: I E 424.

I E 480. Senior Design  
3 Credits (2+3P)  
Multi-disciplinary team design project for external clients. Involves semester long activities including major design report and presentation.  
Prerequisites: senior standing, I E 467.

I E 490. Selected Topics  
1-3 Credits  
May be repeated for a maximum of 9 credits.  
Prerequisite: consent of the head of the department.

I E 505. Directed Readings  
1-3 Credits  
May be repeated for a maximum total of 6 credits.  
Prerequisite: consent of the head of the department.

I E 515. Stochastic Processes Modeling  
3 Credits  
Introduction to the use of stochastic processes in the modeling of physical and natural systems. Use of generating functions, conditional probability and expectation, Poisson processes, random walk models, Markov chains, branching processes, Markov processes, and queuing processes in an applied setting.  
Prerequisites: I E 311 or equivalent; and MATH 392 or equivalent.

I E 522. Queuing Systems  
3 Credits  
Elements and classification of queuing systems, single server models, multi-server models, cost analysis and applications.  
Prerequisite: I E 311 or equivalent.

I E 523. Advanced Engineering Economy  
3 Credits  
Theoretical basis for engineering economy methods, problems of cost estimation, replacement, nonmonetary factors, and feasibility studies. Same as C E 523.

I E 524. Advanced Production and Inventory Control  
3 Credits  
Organization and functions of manufacturing planning and control systems including forecasting, MRP, capacity planning, JIT systems, scheduling and inventory control. Same as I E 424 with differentiated assignments.

I E 525. Systems Synthesis and Design  
3 Credits  
Examination of the production management complex in terms of its components and the synthesis of these components into an effective operating unit. Development of input-output models representing the basis structure of all production activities.

I E 530. Environmental Management Seminar  
1 Credit  
Same as C E 530, E 530, CH E 530.

3 Credits  
Key concepts, terminology, paradigms, and methods of operations research: Linear programming including assignment and transportation algorithms; stochastic analysis, including inventory control and queuing systems; general approaches, including goal, integer, nonlinear and dynamic programming.

I E 533. Linear Programming  
3 Credits  
Linear programming problem formulation, simplex algorithm, theory of linear programming, duality, revised simplex algorithm, and sensitivity analysis.
I E 534. Nonlinear Programming
3 Credits
Theoretical and computational methods to solve optimization problems in engineering, statistics, economics, and operations research. Topics include convexity, optimality conditions, Newton’s method, Lagrange multipliers, search algorithms for unconstrained and constrained problems, as well as barrier and penalty methods. Prerequisite: MATH 192G or equivalent.

I E 535. Discrete Optimization
3 Credits
Combinatorial Optimization problems using both integer programming and graph theoretic approaches. Emphasis on modeling and computational algorithms.

I E 537. Large Scale Systems Engineering
3 Credits
Systems engineering approaches to large-scale complex technological and societal problems. Concepts of interaction and structural graphs, matrices, delta, and Gantt charts. The hall matrix approach, structural concepts, reachability matrices, and cross impact-analysis, modeling and decision making.

I E 539. Fundamentals of Transportation and Routing in Logistics
3 Credits
Introduction to the conceptual, methodological, and mathematical foundations of transportation and routing problems in logistics system. Emphasis on mathematical modeling and computational algorithms.

I E 545. Characterizing Time-Dependent Engineering Data
3 Credits
Theory and techniques employed in the characterization of stochastic processes commonly found in engineering applications. Distribution models include exponential, gamma, Weibull, and extreme value. Design and analysis of experiments involving complete and censored data and elevated stress. Analytical techniques include parametric, nonparametric, and graphical approaches with emphasis on modern computer tools. Exact and approximate maximum-likelihood techniques are stressed. Prerequisite: I E 311 or equivalent.

I E 561. Advanced Safety Engineering
3 Credits
Regulation as well as qualitative, and quantitative methods to achieve and maintain safety in the workplace. Includes liability, worker’s compensation, OSHA, hazard control, safety assessment, cost justification, and system analysis. Prerequisite: graduate status in engineering.

I E 563. Topics in Engineering Administration
3 Credits
Study of qualitative and quantitative aspects. Consideration given to philosophical, psychological, political and social implications of engineering administrative decisions.

I E 567. Design and Implementation of Discrete-Event Simulation
3 Credits
Basic modeling concepts, organizations of simulations, input data analysis, random variate generation, simulation design and analysis, model validation, output analysis, and management of simulations. Taught with I E 467 with differentiated assignments for graduate students.

I E 571. Advanced Quality Control
3 Credits
Advanced topics in quality control and design of experiments for improvement of quality. Prerequisite: I E 311 or equivalent.

I E 575. Advanced Manufacturing Processes
3 Credits
Covers major process parameters in casting, forming, machining, and joining. Process economics and selection of processes design and interactions. Prerequisite: graduate standing.

I E 590. Selected Topics
1-3 Credits
May be repeated for a maximum of 9 credits. Prerequisite: consent of the head of the department.

I E 598. Special Research Programs
1-3 Credits
Individual analytical or experimental investigations. May be repeated for a maximum total of 6 credits. Prerequisite: consent of instructor.

I E 599. Master’s Thesis
15 Credits
Thesis.

I E 610. Topics in Operations Research
3 Credits
Selected topics of current interest, to be designated by subtitle. May be repeated for a maximum of 6 credits.

I E 620. Topics in Computer Modeling
3 Credits
Selected topics of current interest, to be designated by subtitle. May be repeated for a maximum of 6 credits.

I E 630. Topics in Engineering Management
3 Credits
Selected topics of current interest, to be designated by subtitle. May be repeated for a maximum of 6 credits.

I E 690. Selected Topics
1-15 Credits
May be repeated. Prerequisite: consent of department head.

I E 700. Doctoral Dissertation
15 Credits
Dissertation.

Name:

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