The Ingram School of Engineering provides students the background that is essential for the conception, design, development, and manufacture of electrical, electronic, and information technology products and systems. Students may specialize in the areas of networks and communication systems, micro and nano devices and systems, or computer engineering. Proficiency in mathematics is especially important in Electrical Engineering. In order to be admitted to the EE program, a student needs to be qualified to take MATH 2417 or higher. The B.S. with a major in Electrical Engineering and the B.S. with a major in Electrical Engineering with Computer Engineering Concentration are both accredited by the Engineering Accreditation Commission of ABET (www.abet.org) and is accessed through the website http://www.engineering.txstate.edu/.

The B.S. major in Industrial Engineering provides students the background that is essential for improving the productivity, quality, safety, and cost effectiveness of all types of systems and processes. Industrial engineers are typically engaged in the areas of quality assurance, ergonomics, production and operations management, facilities design, work design, system optimization, information technology, and industrial safety. The B.S. major in Industrial Engineering is accredited by the Engineering Accreditation Commission of ABET (www.abet.org). Annual student enrollment and graduation data is posted by the institution and is accessed through the website http://www.engineering.txstate.edu/About/Data.html.

The B.S. major in Manufacturing Engineering is designed to provide students with the mathematics, science, management, engineering, and applications skills needed to become manufacturing engineers. These engineers are typically responsible for promoting manufacturability, process planning, tool design, cost estimation, factory layout, work methods, quality assurance, automation, and systems integration. The degree has a concentration in general manufacturing, mechanical systems or semiconductor/high technology manufacturing. The B.S. major in Manufacturing Engineering is accredited by the Engineering Accreditation Commission of ABET (www.abet.org).

1. To provide students with an exceptional education in various disciplines of engineering.
2. To establish, through dedicated faculty, a nationally recognized research program, preparing interested students to achieve excellence in graduate studies and research, and
3. To serve the State of Texas and the nation by creating highly skilled, diverse, and motivated professionals capable of technological innovation and dedicated to the improvement of society.

The objectives of the program are to produce graduates who, in 3-5 years of receiving the EE degree, attain the necessary skills and abilities to:

1. Analyze, design, develop, optimize, and implement complex systems in the context of modern interdisciplinary engineering work.
2. Contribute to the solution of practical problems in industrial, service, and government organizations by applying skills acquired through formal and lifelong learning.
3. Enjoy fulfilling engineering careers, including professional advancement, entrepreneurship, and the pursuit of graduate studies.
4. Practice engineering while observing appropriate technological, organizational, societal, global, and ethical contexts.

Each graduate is expected to have:

(a) an ability to apply knowledge of mathematics, science, and engineering

(b) an ability to design and conduct experiments, as well as to analyze and interpret data

(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

(d) an ability to function on multidisciplinary teams

(e) an ability to identify, formulate, and solve engineering problems

(f) an understanding of professional and ethical responsibility

(g) an ability to communicate effectively

(h) the broad education necessary to understand the impact of engineering solutions in a global economic, environmental, and societal context

(i) a recognition of the need for, and an ability to engage in lifelong learning

(j) a knowledge of contemporary issues

(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

(l) a knowledge of probability, statistics, and mathematics through differential and integral calculus, differential equations, linear algebra, complex variables, and discrete mathematics

(m) a knowledge of sciences and engineering topics (including computer science) necessary to analyze and design complex electrical and electronic devices, software, and systems containing hardware and software components.

The Industrial Engineering Mission Statement, Program Educational Objectives, and Student Outcomes

Our mission is:
To provide an excellent and innovative education setting to our students so they can learn and discover how complex systems work better. The IE program strives to maintain a comprehensive curriculum that enables students to become leading engineers and/or creative researchers in the global marketplace and/or in graduate studies. The program seeks to collaborate with private and public sectors in the search of methodologies and creative solutions to problems that contribute to the advancement of education, technology, and professional development. Through plans and activities that search to embrace a student population of strong diversity, the program attempts to be a significant provider of global workforce.

Within 3-5 years after graduation, graduates of our IE program are expected to be able to attain the following educational objectives:

1. Perform as industry leaders in the global marketplace, capable of successfully planning, controlling, and implementing large-scale projects.

2. Understand and apply the principles of science, technology, engineering, and math involving industry-relevant problems.

3. Contribute to the profitable growth of industrial economic sectors by using IE analytical tools, effective computational approaches, and systems thinking methodologies.

4. Maintain high standards of professional and ethical responsibility.

5. Work effectively in diverse, multicultural environments emphasizing the application of teamwork and communication skills.

6. Practice life-long learning to sustain technical currency and excellence throughout one’s career. Promote the profession and its benefits to society.

Each student is expected to demonstrate:

(a) an ability to apply knowledge of mathematics, science, and engineering

(b) an ability to design and conduct experiments, as well as to analyze and interpret data

(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

(d) an ability to function on multidisciplinary teams

(e) an ability to identify, formulate, and solve engineering problems

(f) an understanding of professional and ethical responsibility

(g) an ability to communicate effectively

(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

(i) a recognition of the need for, and an ability to engage in life-long learning

(j) a knowledge of contemporary issues

(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

(l) an ability to design, develop, implement, and improve integrated systems that include people, materials, information, equipment, and energy and to accomplish the integration of systems using appropriate analytical, computational, and experimental practices.
The Manufacturing Engineering Mission Statement, Program Educational Objectives, and Student Outcomes

Our mission is:

- To sustain a quality, student-centered, industry-oriented engineering curriculum.
- To attract students and prepare them with the knowledge, practical skills, and abilities to perform as highly competent engineers in the global marketplace and/or in graduate studies.
- To produce graduates skilled in materials and manufacturing processes; process, assembly and product engineering; manufacturing competitiveness and systems design.

Within 3-5 years after graduation, graduates of the Manufacturing Engineering program are expected to be able to attain the following educational objectives:

1. Perform as engineering leaders in the global marketplace.
2. Understand and apply the principles of math, science, and engineering in design and manufacturing related activities.
3. Contribute to the profitable growth of manufacturing businesses.
4. Maintain high standards of professional and ethical responsibility.

Each student is expected to demonstrate:

(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Bachelor of Science (B.S.)

- Major in Electrical Engineering (Computer Engineering Concentration) (http://mycatalog.txstate.edu/undergraduate/science-engineering/ingram-school/electrical-engineering-computer-specialization-bs)
- Major in Industrial Engineering (http://mycatalog.txstate.edu/undergraduate/science-engineering/ingram-school/industrial-engineering-bs)
- Major in Manufacturing Engineering (General Manufacturing Concentration) (http://mycatalog.txstate.edu/undergraduate/science-engineering/ingram-school/manufacturing-engineering-general-concentration-bs)
- Major in Manufacturing Engineering (Mechanical Systems Concentration) (http://mycatalog.txstate.edu/undergraduate/science-engineering/ingram-school/manufacturing-engineering-mechanical-systems-concentration-bs)
- Major in Manufacturing Engineering (Semiconductor Manufacturing Concentration) (http://mycatalog.txstate.edu/undergraduate/science-engineering/ingram-school/manufacturing-engineering-semiconductor-concentration-bs)

Information about graduate programs can be found in the Graduate Catalog (http://mycatalog.txstate.edu/graduate).

Subjects in this school include: EE (p. 3), ENGR (p. 6), IE (p. 7), MFGE (p. 8)

Courses in Electrical Engineering (EE)

EE 2400. Circuits I.
This course provides an introduction to the profession of Electrical Engineering and its specialties. Fundamental DC and sinusoidal steady-state circuit analysis techniques include Ohm's law, power, Kirchoff's laws, and Thevenin and Norton equivalent circuits. Prerequisites: MATH 2471.

4 Credit Hours. 3 Lecture Contact Hours. 2 Lab Contact Hours.
Grade Mode: Standard Letter about Circuits I

EE 2420. Digital Logic.
An introduction to fundamental computer technologies, including Boolean logic design, logic circuits and devices, and basic computer hardware are studied. Laboratories provide hands-on experience with electricity, combinational and sequential digital circuits, and computer hardware. Prerequisite: CS 1428 with a grade of "C" or higher.

4 Credit Hours. 3 Lecture Contact Hours. 2 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter about Digital Logic
**EE 3340. Electromagnetics.**
Wave propagation, Maxwell’s equations, transmission lines, wave guides, and antennas. Prerequisites: MATH 3373 and PHYS 2435 with grades of “C” or higher. Co-requisite: EE 3300 or EE 3400.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

about Electromagnetics

**EE 3350. Electronics I.**
Analysis and design of active device equivalent circuits with emphasis on transistors, switching circuits, and operational amplifiers. Prerequisites: EE 3300 or EE 3400.

**3 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

about Electronics I

**EE 3355. Solid State Devices.**
Semiconductor materials, principles of carrier motion, operating principles and circuit models for diodes, bipolar transistors and field-effect transistors. Introduction to integrated circuits. Prerequisites: EE 3300 or EE 3400.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

about Solid State Devices

**EE 3370. Signals and Systems.**
Frequency domain representation of signals and systems and frequency domain concepts for circuit analysis and design. Transfer function and frequency response, Laplace and z-transforms, Fourier series, Fourier transform, and sampling. Prerequisites: EE 3300 or EE 3400.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

about Signals and Systems

**EE 3400. Circuits II.**
This course includes a brief review of EE 2400, transient analysis, application of Laplace transforms, Bode plots, and network principles. Materials learning in EE 2400 is extended and applied here. Prerequisites: EE 2400 and MATH 3323.

**4 Credit Hours. 3 Lecture Contact Hours. 2 Lab Contact Hours.**

**Grade Mode:** Standard Letter

about Circuits II

**EE 3420. Microprocessors.**
Introduction to microprocessors, principles of operation, assembly language programming, timing analysis, and I/O interfacing. Prerequisites: EE 2420.

**4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Writing Intensive

**Grade Mode:** Standard Letter

about Microprocessors

**EE 3421. Digital Systems Design Using HDL.**
This course will cover the design of digital systems using HDL including implementation of custom microprocessor and peripheral architectures. Prerequisite: EE 3420 with a grade of “C” or higher.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

about Digital Systems Design Using HDL

**EE 3423. Digital Image Processing.**
This course provides the necessary fundamental techniques to analyze and process digital images. It covers principles, concepts, and techniques of digital image processing and computer vision. Prerequisites: CS 1428 and EE 3420 with grades of “C” or higher.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

about Digital Image Processing

**EE 3350. Electronics II.**
Analysis and design of integrated circuits, feedback, and frequency response. Prerequisites: EE 3350.

**3 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

about Electronics II

**EE 3351. Fundamentals of Electroceramics.**
Introduction to binary and ternary phase diagrams, non-centro-symmetric crystal structures and symmetry groups, nonlinear dielectrics (including ferroelectricity, piezoelectricity, pyroelectricity), nonlinear magnetics, oxide wideband gap semiconductors, detectors and sensors, brief introduction to MEMS, radhard electronics, and spintronics technology. Research oriented labs related to materials processing, characterization, fabrication, and testing. Prerequisite: ENGR 2300 or equivalent; Co-requisite: EE 3355; GPA of 2.25 or higher.

**3 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.**

**Grade Mode:** Standard Letter

about Fundamentals of Electroceramics

**EE 3352. Introduction to VLSI Design.**
Analysis of design of CMOS integrated circuits. Introduction to CAD tools for VLSI design. Prerequisites: CS 2420, EE 2420, and EE 3350 with grades of “C” or higher.

**3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.**

**Course Attribute(s):** Lab Required

**Grade Mode:** Standard Letter

about Introduction to VLSI Design

**EE 3353. Fundamentals of Advanced CMOS Technology.**
Key concepts of advanced semiconductor technology including Moore’s law, transition from NMOS to CMOS, CMOS scaling, high-K gate dielectrics, metal electrodes, source/drain scaling technology, new channel materials replacing silicon, and three dimensional device structures. Prerequisite: EE 3355 with a grade of “C” or higher.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

about Fundamentals of Advanced CMOS Technology
EE 4354. Flexible Electronics.
This course will cover the materials systems, processes, device physics and applications of flexible electronics. The materials range from amorphous and nanocrystalline silicon, organic and polymeric semiconductors to solution cast films of carbon nanotubes. Real device discussions include high speed transistors, photovoltaics, flexible flat-panel displays, medical image sensors, etc. Prerequisites: EE 3350, EE 3355, and EE 4350 with grades of "C" or higher, or permission of the instructor.
Grade Mode: Standard Letter
Course Attribute(s): Flexible Electronics
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.

EE 4355. Analog and Mixed Signal Design.
Operational amplifier design applications, feedback, offset, stability, and compensation. Introduction to random signals and noise, discrete time circuitry analog-to-digital converters, and digital-to-analog converters. Prerequisites: EE 3370 and EE 4350.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter
about Analog and Mixed Signal Design
3 Credit Hours. 3 Lecture Contact Hours. 2 Lab Contact Hours.

EE 4358. Introduction to Microelectromechanical Systems.
This course will cover fabrication techniques for microelectromechanical devices and systems as well as provide an introduction to the design of micromechanical transducers. Co-requisite: MFGE 4392.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter
about Microelectromechanical Systems
3 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.

Transmission of signals through linear systems, analog and digital modulation, filtering, and noise. Prerequisites: EE 3300, EE 3370, and IE 3320.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter
about Communication Systems
3 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.

EE 4372. Communication Networks.
Data communication concepts, protocols, algorithms, 7-layer OSI model, physical media, LAN architecture and components, Ethernet, FDDI, TCP/IP, and related standards. Prerequisite: EE 2400 and EE 3420.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter
about Communication Networks
3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.

EE 4374. Introduction to Wireless Communication.
Principles, practice, and system overview of mobile systems. Modulation, demodulation, coding, encoding, and multiple access techniques. Prerequisites: EE 4370.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter
about Introduction to Wireless Communication
3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.

EE 4376. Introduction to Telecommunications.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter
about Introduction to Telecommunications
3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.

EE 4377. Introduction to Digital Signal Processing.
Discrete systems, convolution, spectral analysis, and FIR and IIR filter design. Prerequisites: EE 3370.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter
about Introduction to Digital Signal Processing
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.

EE 4378. Data Compression and Error Control Coding.
Introduction to information theory, information content of messages, entropy and source coding, data compression, channel capacity data translation codes, and fundamentals of error correcting codes. Corequisite: EE 4370.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter
about Data Compression and Error Control Coding
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.

EE 4390. Electrical Engineering Design I.
This course is a team-based design of a system or component, which will include oral presentations and written reports. Prerequisites: EE 3350, EE 3370, and EE 3420 with grades of "C" or higher. Co-requisites: EE 4352 or EE 4370. (WI).
Course Attribute(s): Lab Required
Grade Mode: Standard Letter
about Electrical Engineering Design I
3 Credit Hours. 1 Lecture Contact Hour. 3 Lab Contact Hours.

EE 4391. Electrical Engineering Design II.
Advanced team-based design of a system or component, which will include oral presentations and written reports. Prerequisites: EE 4390. (WI).
Course Attribute(s): Lab Required
Grade Mode: Standard Letter
about Electrical Engineering Design II
3 Credit Hours. 1 Lecture Contact Hour. 3 Lab Contact Hours.

Texas State University
EE 4399A. Dynamic Data Acquisition and Analysis.
Methods for acquiring and analyzing dynamic (time-varying) data. Frequency domain analysis, analog-to-digital conversion, windowing, and digital filtering taught in the context of various industrial applications. Prerequisite: EE 3370 Signals and Systems. about Dynamic Data Acquisition and Analysis
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Standard Letter
about Dynamic Data Acquisition and Analysis

EE 4399B. Overview of Information Theory and Coding.
Fundamentals of Information Theory, Huffman coding, image encoding techniques, Hamming and BCH error control codes, Reed-Solomon coding, convolutional codes and the Viterbi decoding algorithm. about Overview of Information Theory and Coding
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Standard Letter
about Overview of Information Theory and Coding

Courses in Engineering (ENGR)

An introductory communications course in the tools and techniques utilized to produce various types of working drawings. Principles of multiview projections, geometric relationships, shape and size description, and pictorial methods are included with emphasis on technical applications and design problem solving. about Engineering Design Graphics
3 Credit Hours. 2 Lecture Contact Hours. 2 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter
about Engineering Design Graphics

ENGR 2300. Materials Engineering.
Structure, properties and behavior of engineering materials including metals, polymers, composites and ceramics. Mechanical, electrical, magnetic, thermal, and optical properties are covered. Prerequisites: CHEM 1341 or CHEM 1335; CHEM 1141. about Materials Engineering
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter
about Materials Engineering

ENGR 3190. Cooperative Education.
This course provides special problems in engineering for cooperative education students. Problems are related to the student's work assignment and culminate in a technical report. Three hours may be used as technical elective, and one additional hour may be used as free elective; 4 hours may be used toward graduation. Prerequisite: Overall GPA 2.5 or above and approval of department head. about Cooperative Education
1 Credit Hour. 0 Lecture Contact Hours. 40 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Standard Letter
about Cooperative Education

This course covers the principles of mechanic materials and includes the following topics: stress and strain; elastic modulus and Poisson's ratio; constitutive equations; torsion; bending; axial, shear and bending moment diagrams; deflection of beams; and stability of columns. Prerequisite: ENGR 3375 or MATH 3375. about Mechanics of Materials
3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter
about Mechanics of Materials

ENGR 3315. Engineering Economic Analysis.
Interest formulas, economic equivalence, rate of return analysis, techniques of economic analysis for engineering decisions and an introduction to cost estimation. Prerequisite: MATH 1315. about Engineering Economic Analysis
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter
about Engineering Economic Analysis

ENGR 3360. Structural Analysis.
Structural engineering fundamentals to include design loads, reactions, force systems, functions of a structure, and the analysis of statically determinate and indeterminate structures by classical and modern techniques. Prerequisite: ENGR 3311. about Structural Analysis
3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter
about Structural Analysis

ENGR 3373. Circuits and Devices.
DC and AC circuit analysis, network theorems, electromechanical devices, electronic devices and an introduction to amplifiers, oscillators and operational amplifiers. Prerequisite: PHYS 2425. about Circuits and Devices
3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter
about Circuits and Devices

ENGR 3375. Mechanics for Engineers.
This course covers statics, using a vector approach to mechanics. Prerequisite: PHYS 1430. Co-requisite: MATH 2472. about Mechanics for Engineers
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter
about Mechanics for Engineers

ENGR 4390. Internship.
Supervised on-the-job professional learning experience in engineering and other technical areas. This course provides practical work experience in their particular field of interest. about Internship
3 Credit Hours. 0 Lecture Contact Hours. 20 Lab Contact Hours.
Grade Mode: Standard Letter
about Internship
Open to undergraduate students on an independent basis by arrangement with the faculty member concerned. Requires school director's approval. Repeatable for credit with different emphasis. Prerequisite: junior or senior standing.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Standard Letter
about Independent Studies in Engineering

Courses in Industrial Engineering (IE)

IE 3310. Project Management for Engineers.
Basic principles governing the efficient and effective management of engineering projects. Topics include project planning, scheduling, and cost estimation procedures. Prerequisite: ENGR 3315. (WI).
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Writing Intensive
Grade Mode: Standard Letter
about Project Management for Engineers

Fundamentals of probability and statistical inference for engineering applications, probability distributions, parameter estimation, hypothesis testing, and analysis of variance. Prerequisite: MATH 2472.
3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Grade Mode: Standard Letter
about Engineering Statistics

IE 3330. Quality Engineering.
Quality assurance systems, quality costs, statistical quality control, and approaches for engineering quality into products and processes. Prerequisite: IE 3320.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter
about Quality Engineering

This course teaches models in operations research including linear programs, the simplex method, duality theory, sensitivity analysis, integer programs, and network flows. The emphasis is in learning to recognize, formulate, solve, and analyze practical industrial problems. The course also teaches commercial mathematical programming languages. Prerequisites: CS 1428, MATH 3377, ENGR 3315.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter
about Operations Research

IE 3360. Methods Engineering and Ergonomics.
This course is a survey of methods for assessing and improving performance of individuals and groups in organizations. Techniques include various basic industrial engineering tools, work analysis, data acquisition and application, performance evaluation and appraisal, and work measurement procedures. Prerequisite: IE 3320.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter
about Methods Engineering and Ergonomics

IE 4310. Statistical Design of Experiments.
Statistically designed experiments for engineering applications. Topics include analysis of variance, randomized complete designs, factorial designs, empirical models generated from controlled experiments, and response surfaces. Prerequisite: IE 3320.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter
about Statistical Design of Experiments

IE 4320. Integrated Production Systems.
Basic concepts in the design and control of integrated production systems to include forecasting, inventory models, material requirements planning, scheduling, planning, and shop floor control. Coverage will include both traditional and kanban systems. Prerequisite: IE 3340.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter
about Integrated Production Systems

IE 4330. Reliability Engineering.
Reliability of components and systems, reliability models, life testing, failure analysis, and maintainability. Prerequisite: IE 3320.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter
about Reliability Engineering

IE 4340. Optimization Techniques.
Mathematical modeling and computational methods for linear, integer, and nonlinear programming problems. Prerequisite: IE 3340.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter
about Optimization Techniques

IE 4350. Supply-Chain Engineering.
The analysis of supply chain problems to include facility location, customer assignment, vehicle routing, inventory management, and the role of information and decision support systems in supply chains. Prerequisite: IE 3340.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter
about Supply-Chain Engineering
IE 4355. Facilities Planning.
Planning, design, and analysis of facilities. Emphasizes the principles and methods used for solving plant layout, facility location, material handling, automation, computer integration, and warehouse operations.

about Facilities Planning

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

IE 4360. Human Factors Design.
This course will emphasize the applications of human factors engineering to systems design. Prerequisites: IE 3360. (WI).

about Human Factors Design

3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

Probabilistic models in operations research to include queuing theory, simulation, and Markov chains. Emphasis will be placed on modeling applications to solve problems in industry and computing. Prerequisite(s): IE 3320 and CS 1428.

about Probabilistic Operations Research

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

IE 4380. Industrial Safety.
This course is a survey of occupational safety and hazards control. Topics include the history of occupational safety; hazard sources related to humans, environment, and machines; and engineering management of hazards.

about Industrial Safety

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Writing Intensive
Grade Mode: Standard Letter

IE 4390. Industrial Engineering Capstone Design.
Students form teams and apply industrial engineering principles to develop and implement solutions to industrial problems and/or systems engineering issues. Prerequisites: IE 3310, IE 3330; and at least two of: IE 3360, IE 4310, IE 4310, IE 4355, IE 4370 and MFGE 4396. Corequisite(s): IE 4320 and IE 4350.

about Industrial Engineering Capstone Design

3 Credit Hours. 3 Lecture Contact Hours. 2 Lab Contact Hours.
Grade Mode: Standard Letter

IE 4399A. Six Sigma Methodologies.
This course covers the principles and methodologies of Six Sigma. Emphasis is on the tools and techniques used in Six Sigma projects, including statistical process control, experimental design, and project management. Students will develop and complete a Six Sigma project in industry. Prerequisite(s): IE 3310, ID 3330, and ID 4310.

about Six Sigma Methodologies

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Standard Letter

IE 4399B. Human Computer Interaction.
Introduces the fundamentals of human-computer interaction relative to interactive computer applications and associated interfaces. Principles and methodologies of usability testing will highlight relationships between human factors, design, and cognitive psychology in the development of computer applications. A variety of assessment and validation methodologies are applied. Prerequisite: Faculty advisor approval.

about Human Computer Interaction

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Standard Letter

IE 4399C. Engineering Statistics II.
This course is the continuation of IE 3320 Engineering Statistics I and covers simple and multiple regression analysis, analysis of variance, $2^k$ Factorial Experiments, and the use of statistical packages. Prerequisite: IE 3320.

about Engineering Statistics II

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Standard Letter

IE 4399D. Modern Heuristic Optimization Techniques.
Heuristic methods that search beyond local optima such as simulated annealing, tabu search, genetic algorithms, ant-colony systems, and particle swarm. Papers from the literature, problem-specific heuristics, evaluation methods and serial/parallel implementations are discussed. This course is an advanced undergraduate course for students in engineering and related fields. Prerequisites: IE 3340, CS 1428.

about Modern Heuristic Optimization Techniques

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Standard Letter

Courses in Manufacturing Engineering (MFGE)

MFGE 2132. Manufacturing Processes Lab.
Hands-on experience in variety of material removal processes such as turning, milling, drilling, and CNC machining; joining processes such as gas/arc welding, and soldering; metal casting, polymer and composite processing, and microelectronics manufacturing. Prerequisite or corequisite: MFGE 2332.

about Manufacturing Processes Lab

1 Credit Hour. 0 Lecture Contact Hours. 2 Lab Contact Hours.
Grade Mode: Standard Letter

MFGE 2332. Material Selection and Manufacturing Processes.
Overview of material processing, material selection and process parameter determination. Processes covered include: material removal, forming, casting, polymer processing, semiconductor manufacturing and assembly processes. Laboratory activities provide opportunities for applying the design through manufacture activities of the product cycle. Prerequisite: ENGR 2300. Corequisite: ENGR 2300.

about Material Selection and Manufacturing Processes

3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Grade Mode: Standard Letter

MFGE 2334. Manufacturing Processes Lab.
Hands-on experience in variety of material removal processes such as turning, milling, drilling, and CNC machining; joining processes such as gas/arc welding, and soldering; metal casting, polymer and composite processing, and microelectronics manufacturing. Prerequisite or corequisite: MFGE 2332.

about Manufacturing Processes Lab

1 Credit Hour. 0 Lecture Contact Hours. 2 Lab Contact Hours.
Grade Mode: Standard Letter

MFGE 2338. Manufacturing Processes.
Overview of material processing, material selection and process parameter determination. Processes covered include: material removal, forming, casting, polymer processing, semiconductor manufacturing and assembly processes. Laboratory activities provide opportunities for applying the design through manufacture activities of the product cycle. Prerequisite: ENGR 2300. Corequisite: ENGR 2300.

about Material Selection and Manufacturing Processes

3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Grade Mode: Standard Letter
Topics include design process, description of wireframe/surface/solid models, transformation and manipulation of objects, finite element analysis, data exchange, process planning, machine elements, fundamentals of numerical control programming for turning and milling processes, fundamentals of CAD/CAM systems, CNC code generation by CAD/CAM software, waterjet, and plasma cutting. Prerequisites: ENGR 1313 and MFGE2332.
about Computer Aided Design and Manufacturing
3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Grade Mode: Standard Letter
about Computer Aided Design and Manufacturing

This course will cover the general procedures in designing various machine elements. These elements include shafts and flexible elements, springs, welded/riveted/brazed joints, screw fasteners, rolling/sliding contact bearings, gears, cams, and followers. Emphasis will be placed on using standard design practices. Prerequisite: ENGR 3311 or TECH 2351.
about Design of Machine Elements
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter
about Design of Machine Elements

MFGE 3357. Polymer Properties and Processing.
Structure, physical & mechanical properties, design considerations and processing methods for polymer-based materials are presented. Processing methods include: injection molding, blow molding, thermoforming, compression molding, extrusion, filament winding, lay-up methods, vacuum bag molding and poltrusion. Prerequisite: MFGE 2332 or TECH 4362.
about Polymer Properties and Processing
3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Grade Mode: Standard Letter
about Polymer Properties and Processing

MFGE 3367. Control Systems and Instrumentation.
The theory of automated control systems and its applications to manufacturing systems are covered in this course. Topics covered include: modeling of systems, time and frequency domain feedback control systems, stability analysis, transducer and sensor technology and digital control. Prerequisites: PHYS 1430 and one of the following MFGE 2332, TECH 4362 or EE 3370. Co-requisite: MATH 3323.
about Control Systems and Instrumentation
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter
about Control Systems and Instrumentation

MFGE 3392. Microelectronics Manufacturing I.
Provides an overview of integrated circuit fabrication including crystal growth, wafer preparation, epitaxial growth, oxidation, diffusion, ion-implantation, thin film deposition, lithography, etching, device and circuit formation, packaging and testing. The laboratory component involves production and testing of a functional semiconductor device. Prerequisites: CHEM 1141 and CHEM 1341.
about Microelectronics Manufacturing I
3 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter
about Microelectronics Manufacturing I

MFGE 3394. Microelectronics Manufacturing II.
Topics include: atomic models for diffusion, oxidation and ion implantation; topics related to thin film processes i.e. CVD, PVD; planarization by chemical-mechanical polishing and rapid thermal processing; and process integration for bipolar and MOS device fabrication. Students will design processes and model them using a simulation. Prerequisite: MFGE 4392.
about Microelectronics Manufacturing II
3 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Grade Mode: Standard Letter
about Microelectronics Manufacturing II

This course is an overview of computer integrated manufacturing is presented. Topics include control strategies for manufacturing systems, automated material handling systems, production planning, shop floor control, manufacturing execution systems, manufacturing databases and their integration, data communication and protocols and man/machine interfaces. Prerequisite: MFGE 3316. (WI).
about Computer Integrated Manufacturing
3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter
about Computer Integrated Manufacturing
MFGE 4396. Manufacturing Systems Design.
Applications of simulation modeling to the design and analysis of manufacturing systems are presented in this course. Topics covered include queuing theory and discrete event simulation methods. Design projects will involve the use of current simulation language for modeling and analysis of manufacturing systems. Prerequisites: IE 3320. (WI).

3 Credit Hours. 3 Lecture Contact Hours. 2 Lab Contact Hours.
Course Attribute(s): Lab Required|Writing Intensive
Grade Mode: Standard Letter

about Manufacturing Systems Design

MFGE 4399A. Reverse Engineering and Rapid Prototyping.
In the course 3D scanning technology for design, analysis, and inspection, is covered. Also, applications of the 3D scanning in reverse engineering and different rapid prototyping processes in a hands-on approach will be explained in this course.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter

about Reverse Engineering and Rapid Prototyping

MFGE 4399B. Introduction to Reinforced Polymer Nanocomposites in Industrial Applications.
Introductory course in reinforced polymer nanocomposites focusing on materials, manufacturing, characterization, and applications. Include, primarily nanoclay polymer matrix composites. Thrust will be the challenges in low-cost manufacturing for industrial applications, commercial successes, its impact on current material market, and future.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter

about Introduction to Reinforced Polymer Nanocomposites in Industrial Applications

MFGE 4399C. Introduction to Industrial Robotics.
This course will cover the basic principles and techniques involved in industrial robotics. Emphasis will be placed on industrial robot applications, analysis of robot manipulators, components of industrial robots, robot programming and control. Prerequisite: MFGE 4376.

3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter

about Introduction to Industrial Robotics