

Iowa State University

College of Engineering

Summary of Majors, Minors, Areas of Emphasis, and Research Focus Areas by Department

Undergraduate Majors and Areas of Emphasis	Minors	Graduate Majors and Major Research Areas
Aerospace Engineering (AerE)		
<ul style="list-style-type: none"> - Aerospace Engineering 	<p>See list of minors open to all students</p>	<ul style="list-style-type: none"> - Aerospace Engineering (MEng, MS, PhD) - Engineering Mechanics (MEng, MS, PhD) <p>Research Focus Areas</p> <ul style="list-style-type: none"> ○ Aerodynamics and Aero-Structural Interaction ○ Advanced Materials Systems ○ Aviation Biofuels ○ Complex Systems and Optimization ○ Guidance, Navigation, Controls, and Astrodynamics ○ Nondestructive Evaluation
Agricultural and Biosystems Engineering (ABE)		
<ul style="list-style-type: none"> - Agricultural Engineering <ul style="list-style-type: none"> ○ Animal Production Systems Eng. ○ Land and Water Resources Eng. ○ Power and Machinery Eng. - Biological Systems Engineering - Agricultural Systems Technology* - Industrial Technology* <p>*Technology degrees offered through ABE</p>	<p>See list of minors open to all students</p>	<ul style="list-style-type: none"> - Agricultural Engineering (MEng, MS, PhD) - Industrial & Agricultural Technology (MS, PhD) <p>Research Focus Areas</p> <ul style="list-style-type: none"> ○ Advanced Machinery Engineering and Mfg. Systems ○ Animal Production Systems Engineering ○ Biological and Process Engineering and Technology ○ Occupational Safety Engineering ○ Land and Water Resources Engineering
Chemical and Biological Engineering (CBE)		
<ul style="list-style-type: none"> - Chemical Engineering 	<p>See list of minors open to all students</p>	<ul style="list-style-type: none"> - Chemical Engineering (MEng, MS, PhD) <p>Research Focus Areas</p> <ul style="list-style-type: none"> ○ Advanced and Nanostructured Materials ○ Biorenewables ○ Catalysis & Reaction Engineering ○ Computational Fluid Dynamics ○ Health Care Technology & Biomedical Eng. ○ Renewable Energy
Civil, Construction & Environmental Engineering (CCEE)		
<ul style="list-style-type: none"> - Civil <ul style="list-style-type: none"> ○ Environmental ○ Geotechnical ○ Structural ○ Transportation - Construction Engineering <ul style="list-style-type: none"> ○ Heavy/Highway Construction ○ Building Construction ○ Mechanical Construction ○ Electrical Construction 	<p>See list of minors open to all students</p>	<ul style="list-style-type: none"> - Civil Engineering (MEng, MS, PhD) <ul style="list-style-type: none"> ○ Construction Engineering & Management ○ Environmental & Water Resources Engineering ○ Geotechnical/Materials Engineering ○ Structural Engineering ○ Transportation Engineering

Electrical and Computer Engineering (ECpE)

<ul style="list-style-type: none"> - Computer Engineering <ul style="list-style-type: none"> o Computing and Networking Systems o Secure and Reliable Computing o Software Engineering Systems o Very Large Scale Integration (VLSI) Design o Embedded System Design - Electrical Engineering <ul style="list-style-type: none"> o Communications and Signal Processing o Electromagnetics, Microwave, and Nondestructive Evaluation o Electric Power and Energy Systems o Microelectronics and Photonics o Systems and Controls o Very Large Scale Integration (VLSI) Design - Software Engineering 	<p>See list of minors open to all students</p>	<ul style="list-style-type: none"> - Computer Engineering (MEng, MS, PhD) - Electrical Engineering (MEng, MS, PhD) <p>Research Focus Areas:</p> <ul style="list-style-type: none"> o Bioengineering o Communications & Signal Processing o Computing & Networking Systems o Electric Power & Energy Systems o Electromagnetic, Microwave, & Nondestructive Evaluation o Microelectronics & Photonics o Secure & Reliable Computing (Information Assurance) o Software Systems o Systems & Controls o Very Large Scale Integration (VLSI)
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Industrial and Manufacturing Systems Engineering (IMSE)

<ul style="list-style-type: none"> - Industrial Engineering <ul style="list-style-type: none"> o Engineering Management o Human Factors o Operations Research o Manufacturing Systems 	<p>See list of minors open to all students</p>	<ul style="list-style-type: none"> - Industrial Engineering (MEng, MS, PhD) <p>Research Focus Areas</p> <ul style="list-style-type: none"> o Operations Research o Advanced Manufacturing Research o Ergonomics and Human Factors o Information Engineering
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Materials Science and Engineering (MSE)

<ul style="list-style-type: none"> - Materials Engineering <ul style="list-style-type: none"> o Ceramics o Electronics o Metals o Polymers 	<p>See list of minors open to all students</p>	<ul style="list-style-type: none"> - Materials Science & Engineering (MEng, MS, PhD) <p>Research Focus Areas</p> <ul style="list-style-type: none"> o Synthesis and Processing of Materials o Structure of Materials o Properties of Materials o Applications of Materials
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Mechanical Engineering (ME)

<ul style="list-style-type: none"> - Mechanical Engineering <ul style="list-style-type: none"> o Design and Optimization o Materials and Manufacturing o Thermal Fluids o Dynamic Systems 	<p>See list of minors open to all students</p>	<ul style="list-style-type: none"> - Mechanical Engineering MEng, MS, PhD) <p>Research Focus Areas</p> <ul style="list-style-type: none"> o Biological and Nanoscale Sciences o Clean Energy Technologies o Complex Fluid Systems o Design and Manufacturing Innovation o Simulation and Visualization
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<p>Engineering Minors Open to All Engineering Students</p> <ul style="list-style-type: none"> - Bioengineering - Energy Systems - Engineering Sales - Nondestructive Evaluation - Nuclear Engineering <p>Interdisciplinary Minors Open to Engineering Students</p> <ul style="list-style-type: none"> - Entrepreneurial Studies (Undergraduate students only) - Sustainability - Wind Energy 	<p>Interdepartmental Graduate Programs [Participating Departments]</p> <ul style="list-style-type: none"> o Bioinformatics & Computational Biology (PhD) [CBE, ECpE and MSE] o Biorenewable Resources and Technology (MS, PhD) [ABE, CBE, CCEE, and ME] o Engineering Management (MEng) o Environmental Science (MS, PhD) [ABE and CCEE] o Human-Computer Interaction (MS, PhD, & Cert) [AerE, ABE, CCEE, ECpE, IMSE, and ME] o Information Assurance (MS, PhD) [ECpE and IMSE] o Sustainable Agriculture (MS, PhD) [ABE] o Systems Engineering (MEng) [AerE, ECpE, IMSE and ME] o Toxicology (MS, PhD) [ABE and CBE] o Transportation (MS) [CCEE] o Wind Energy Science (PhD) [AeroE, CCEE, ECpE, IMSE, MSE, ME]
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Iowa State University and the College of Engineering

Iowa State University is a comprehensive, land grant, Carnegie Doctoral/Research Extensive University with an enrollment of over 33,000 students. ISU dates back to 1858 and it was designated the first land-grant college in 1864 when Iowa became the first state to accept the terms of the federal Morrill Act. ISU's nearly 2000 acre, park like campus is located in Ames, Iowa. Iowa State is ranked second nationally in R&D 100 awards, second in research licenses and options, and tenth in patents among all U.S. universities.

The College of Engineering has over 8,200 students and 235 faculty members. The faculty and students conduct over \$83 million in research annually. The College is the 9th largest in the U.S. and typically ranks among the top-25 engineering programs at public universities. All 12 of the College's engineering programs are accredited by ABET and the last review occurred in 2013. The College is comprised of eight departments and occupies ten buildings on the west side of the ISU campus.

Departments and Degree Programs

The Department of Aerospace Engineering (AeroE)

Aeronautical Engineering courses were offered by Iowa State as early as 1929 and the department was created in 1942. The department offers degrees in Aerospace Engineering and Engineering Mechanics. Research focus areas for the department include: Aerodynamics and Aero-Structural Interaction; Advanced Materials Systems; Aviation Biofuels; Complex Systems and Optimization; Guidance, Navigation, Controls, and Astrodynamics; and Nondestructive Evaluation. The department has a long list of well accomplished alumni including former astronaut, Clayton Anderson, who is now a member of the faculty. U.S. News and World Report Ranks the undergraduate program at #20 in the Nation and the graduate program at #26 among public universities (2014).

Aerospace Engineering (BS, MEng, MS, PhD)

Aerospace engineers are primarily interested in the design, analysis, testing, and overall operation of vehicles and systems that operate in air, water, and space. The ISU curriculum is designed to provide the student with an education in the fundamental principles of aerodynamics, flight dynamics, propulsion, structural mechanics, flight controls, design, testing, and space technologies. In addition to core engineering courses, AeroEs take classes in dynamics (forces on moving objects), thermodynamics (heat movement), flight structures, flight controls, propulsion, and aerospace materials. Some electives include: astrodynamics, wind energy, composites, wind energy, and spacecraft systems.

Engineering Mechanics (MEng, MS, PhD)

Engineering mechanics students acquire an understanding of the basic principles and analysis techniques pertaining to the static and dynamic behavior of rigid media, deformable solids, fluids, and gasses. Physical properties of engineering materials are studied and tested in the laboratory.

The Department of Agricultural and Biological Systems Engineering (ABE)

Since 1905, the Department of Agricultural Engineering, now the Department of Agricultural and Biosystems Engineering (ABE), has been a leader in providing engineering solutions to agricultural problems in the United States and the world. The Department was the first in the world to grant a degree in Agricultural Engineering. Agricultural and Biological Systems Engineering applies engineering

science and technology to agricultural production and processing. The ABE program combines the disciplines of animal biology, plant biology, and mechanical, civil, electrical and chemical engineering principles with knowledge of agricultural principles. The ABE Department resides in both the College of Engineering and the College of Agriculture and Life Sciences. The Department offers degrees in Agricultural Engineering and Biological Systems Engineering, as well as several technology degrees. (Information on the Agricultural Systems Technology and the Industrial Technology degrees can be found in the Related Technical Majors section of this documents.) Research focus areas for the department include: Advanced Machinery Engineering and Manufacturing Systems, Animal Production Systems Engineering, Biological and Process Engineering and Technology, Occupational Safety Engineering, and Land and Water Resources Engineering.

Agricultural Engineering (BS, MEng, MS, PhD)

Agricultural engineering graduates contribute to the analysis and design of machinery, animal housing, and environmental systems for the production, processing, storage, handling, distribution, and use of food, feed, fiber and other biomaterials. They also focus on the management of related natural resources. At ISU, agricultural engineering students can specialize in one of the following three areas:

- **Animal Production Systems Engineers** are focused on ensuring sustainable development of livestock and poultry industries.
- **Land and Water Resource Engineers** are focused on developing solutions and best management practices that protect and conserve the soil and water resources.
- **Power and Machinery Engineers** are focused on engineering new technologies and systems which enhance the productivity, efficiency, and performance of advanced machinery and manufacturing systems.

Biological Systems Engineering (BS)

Biological systems engineering graduates integrate life sciences with engineering to solve problems related to biological systems. These biological systems may include microbes, plants, animals, humans and/or ecosystems. Biological systems engineers use their understanding of engineering to analyze organisms or ecosystems, and their knowledge of biological systems to inspire and inform their designs. Biological systems engineering design may include developing processes and systems that monitor, simulate, replace, modify, control, optimize, or utilize the mechanisms of living organisms and their products. The BSE program has the following four options:

- **Biorenewable Resources Engineering** focuses on understanding the economics, environmental impacts, and sustainability of biorenewable resource production systems, biomass-derived fuels, and processing of biomass for energy and/or chemicals.
- **Bioenvironmental Engineering** focuses on the biology and engineering principles relevant to soil, water, and air quality.
- **Food Engineering** focuses on the science and engineering needed to design and operate modern food processing systems.
- The **Pre-Professional and Pre-Graduate Option** provides a springboard into other professions – from science (via MS – PhD route) to medicine and law.

The Department of Chemical and Biological Engineering (CBE)

The Department of Chemical and Biological Engineering (CBE) has a history dating back to 1913 when one of the first chemical engineering programs in the country was established. The CBE Department spends about \$12 million each year conducting research in the following focus areas: Advanced and

Nanostructured Materials, Biorenewables, Catalysis & Reaction Engineering, Computational Fluid Dynamics, Health Care Technology & Biomedical Engineering, and Renewable Energy. Through the CBE department, Iowa State University is nationally recognized for its initiatives in bioinformatics, biomaterials, bioproducts, metabolic/tissue engineering, multiphase computational fluid dynamics, advanced polymeric materials, and nanostructured materials.

Chemical Engineering (BS, MEng, MS, PhD)

Chemical engineering students apply the physical sciences (e.g., chemistry and physics) and/or life sciences (e.g., biology, microbiology and biochemistry) to processes that convert raw materials or chemicals into more useful forms. In addition, chemical engineers develop new materials and related techniques that are often essential to related fields such as nanotechnology, fuel cells and biomedical engineering. Since chemical engineering is a very diverse field, the ISU program is flexible so students can tailor their coursework to match their interests. Core courses include Chemical Reaction Engineering, Chemical Thermodynamics, Separations, Transport Phenomena, Material & Energy Balance, Process Control, and Process and Plant Design.

Some chemical engineering students enhance their academic preparation for the growing opportunities in the biological-related industries by adding the biological engineering option to the standard chemical engineering program. The Biological Engineering Option includes electives in Biochemistry, Genetics, and Physiological Chemistry.

The Department of Civil, Construction, and Environmental Engineering (CCEE)

The Department of Civil, Construction, and Environmental Engineering (CCEE) contains two academic programs – civil engineering and construction engineering. Civil engineering was one of the first engineering curricula offered at ISU in 1871– the other was mechanical engineering. The Construction Engineering Program has a history at ISU dating back to 1960. Research focus areas for the department include: Construction Engineering & Management, Environmental & Water Resources Engineering, Geotechnical/Materials Engineering, Structural Engineering, and Transportation Engineering. CCEE students benefit from the department's close ties with the Institute for Transportation (InTrans), which oversees 11 centers and programs focused on transportation research, education and outreach.

Civil Engineering (BS, MEng, MS, PhD)

Civil engineers are primarily interested in the design, construction, and maintenance of works like roads, bridges, canals, dams, and buildings. While the interests of civil engineers are often focused on the civil structures, their design and analysis skills are often used in the engineering of structures in other industries. At ISU the CE curriculum is focused on breadth and students can choose one of the following areas of emphasis:

- **Environmental** focuses on systems and structures for removing contaminants from water, reducing nonhazardous solid waste volumes, eliminating pollutants from the air, and developing water supplies.
- **Geotechnical** focuses on developing projects below ground level and determining ways to stabilize soil and support structures on and in the ground.
- **Structural** focuses on designing structures that can withstand design loads including those from wind, temperature changes, earthquakes, and other forces.
- **Transportation** focuses on determining ways to meet the travel needs of people and goods on land, air, and water.

Construction Engineering

The ISU Construction Engineering Program is the largest and one of only seven ABET accredited programs in the U.S. Construction engineers focus on the planning and execution of the designs and are a cross between a civil engineer and a construction manager. The areas of emphasis for ISU construction engineering include:

- **Heavy/Highway Construction**
- **Building Construction**
- **Mechanical Construction**
- **Electrical Construction**

The Department of Electrical and Computer Engineering (ECpE)

The Department of Electrical Engineering was established in 1909 and Computer Engineering was added to the title in 1984. Faculty, students, and alumni of the ECpE Department played key roles in pioneering a number of important inventions including the first electronic digital computer, the encoding process for FAX machines, the first portable phone, medical ultrasound technology, the first handheld scientific calculator, and the infant respiratory augmentor. The ECpE Department offers degrees in Electrical Engineering, Computer Engineering, and Software Engineering. Research Focus Areas for the department include: Bioengineering; Communications & Signal Processing; Computing & Networking Systems; Electric Power & Energy Systems; Electromagnetic, Microwave, & Nondestructive Evaluation; Microelectronics & Photonics; Secure & Reliable Computing (Information Assurance); Software Systems; Systems & Controls; and Very Large Scale Integration (VLSI).

Computer Engineering (BS, MEng, MS, PhD)

Computer engineers integrate several fields of electrical engineering and computer science to design and develop computer systems and networks. Computer engineers commonly work on the design of individual circuits, microprocessors, personal computers, and supercomputers. Tasks often involve designing VLSI chips, sensors, mixed signal circuit boards, and operating systems; and writing software and firmware for computers and controllers. Computer engineers are key contributors to the development of automation/robotic systems, which integrate sensors, communications, decision making and motor control. The ISU program is also particularly strong in the areas of information and networking technology.

Electrical Engineering (BS, MEng, MS, PhD)

Electrical engineers focus on large and small electrical and electromagnetic applications. The electrical engineering curriculum at ISU offers a number of emphasis areas at the undergraduate level, including control systems, microelectronics and photonics, VLSI, electric power and energy systems, and communications and signal processing, and electromagnetics and nondestructive evaluation. Students are required to choose at least one course sequence that focuses on one of these areas and students may also take elective courses in computer networking, security, computer architecture, digital systems, and software.

Software Engineering (BS)

Software engineers focus on the designing, implementing, and maintaining software systems that are reliable, efficient, and affordable. Software engineers also work in application design, which involves designing or coding new programs and applications to meet a specific need. The software engineering curriculum is jointly administered by the Department of Computer Science and Department of Electrical and Computer Engineering. Iowa State University is one of the few

universities in the nation to offer a software engineering degree with courses in both computer science and computer engineering.

The Department of Industrial and Manufacturing Systems Engineering (IMSE)

An industrial engineering options for mechanical engineers was first introduced at ISU in 1919. The program grew and changed many times over the years and was given its current title in 1989. The IMSE Department has the following five focus areas for undergraduate students: engineering management, manufacturing, operations research, human factors, and enterprise computing. Students also have the option to generalize and take a mixture of courses from any of the five areas. Research focus areas for the IMSE Department include: Operations Research, Advanced Manufacturing, Ergonomics, and Information Engineering.

Industrial Engineering (BS, MEng, MS, PhD)

Industrial engineers design, develop, implement, and improve integrated systems that include people, materials, information, equipment, and energy. Industrial engineers often focus on issues related to human factors, operations research, engineering management, manufacturing engineering, and quality. Industrial engineers often work to optimize complex processes or systems. At the undergraduate level, students can choose a set of electives in one of the following focus areas:

- **Engineering Management** focuses on the strategies necessary for solving internal and external problems of a company in areas such as production, quality, project management, sales, and marketing strategies.
- **Human Factors** focuses on the relationships between people and their work tasks, machines, information, and environment.
- **Operations Research** focuses on making good engineering decisions using quantitative models and methods for production and service systems such as, inventory control, scheduling, transportation, and logistics.
- **Manufacturing Systems** focuses on the design, analyze, operate, and control manufacturing processes and systems.
- **Enterprise Informatics** focuses on the integration and use of information from the functional units of an enterprise as well as between multiple enterprises.

The Department of Materials Science and Engineering (MSE)

ISU's Materials Science and Engineering Department is one of the largest and top ranking materials programs in the nation. The Department's history dates back to 1906 when a course in ceramic engineering was first offered. Metallurgy got its start at ISU with Professor Frank Spedding pioneering work on the purification of rare earth metals in the late 1930's. Spedding played a major role in creating the Institute of Atomic Research and the Ames Laboratory at ISU in 1947. Ceramics and Metallurgy were individual departments at one time but were merged in 1975 to form the Department of Materials Science and Engineering. The association that the MSE Department has with the Ames Laboratory and several other respected research centers, such as the Microelectronic Research Center, the Center for Nondestructive Evaluation, and the Center for Advanced Technology Development, is one of the reasons that ISU has such a strong materials engineering program. The Department has many accomplished faculty members including Dan Schechtman who was awarded the 2011 Nobel Prize in Chemistry for his discovery of quasicrystals. The Department offers an undergraduate degree in Materials Engineering and a graduate degree in Materials Science and Engineering.

Materials Engineering (BS)

Materials engineers understand the relationship between the structure of materials at atomic or molecular scales and their macroscopic properties. The materials engineering coursework encompasses all four of the major elements of materials science and engineering, which includes synthesis and processing, structure, properties, and applications of materials. Undergraduate students choose a minimum of two areas of specialization, which include:

- **Ceramics**
- **Electronics**
- **Metals**
- **Polymers**

Materials Science and Engineering (MEng, MS, PhD)

The MSE graduate program is built on a foundation of thermodynamics, kinetics of phase transformations, mechanical behavior, physical properties, solid state science, and the structure and chemistry of materials. Advanced studies are offered in many areas of materials science and engineering, including the design and control of materials for structural, electronic, photonic, magnetic, optical, and biological functionality. The department awards M. Engr., M.S., and Ph.D. degrees in Materials Science and Engineering. An opportunity to complete and obtain a certificate in Nondestructive Evaluation (NDE) is also an option for students. The M.S. and Ph.D. programs are highly flexible and research-oriented, where students work closely with their major professor in tailoring the various academic and research components to match their interests.

The Department of Mechanical Engineering (ME)

The Department of Mechanical Engineering has administered one of the largest mechanical engineering programs in the United States for more than 100 years and ranks in the top ten nationally in terms of bachelor's degrees awarded. ISU's first diploma was awarded in 1872 to Edgar Stanton in the discipline of "mechanic arts," which included mechanical engineering. Today, more undergraduate students are enrolled in mechanical engineering than in any other discipline at the university. The department has internationally acclaimed research programs in biological and nanoscale sciences, clean energy technologies, complex fluid systems, design and manufacturing innovation, and simulation and visualization.

Mechanical Engineering (BS, MEng, MS, PhD)

Mechanical engineering involves the production and usage of heat and mechanical power for the design, production, and operation of machines and tools. Mechanical engineers apply the principles of physics and materials science for analysis, design, manufacturing, and maintenance of mechanical systems. After completion of the basic engineering program, the mechanical engineering core curriculum is designed to provide undergraduate students exposure to each of the four major areas in the field:

- **Design and Optimization**
- **Materials and Manufacturing**
- **Thermal Fluids**
- **Dynamic Systems**

Engineering Minors Open to Engineering Students

Bioengineering Minor

The Bioengineering Minor provides students with a foundation of core biology and engineering. The goal of this cross-disciplinary program is to educate undergraduate engineering students in sound engineering principles as they relate to the understanding and manipulation of biological systems at multiple scales starting from macromolecules to complex, interconnected biological systems. Students who complete this minor will be able to serve engineering needs in the bioeconomy, specifically in the areas of biorenewables, agriculture, and health sciences.

Energy Systems Minor

The goal of the Energy Systems Minor is to provide students with focused educational opportunities in the broad area of energy systems. Energy systems are anything that generates, converts, distributes or uses energy. Graduates with this minor understand broad energy perspectives, the language of energy systems, and the economic, environmental, and policy issues related to energy.

Engineering Sales Minor

The Engineering Sales Minor is a 15 credit minor that complements the technical training in the student's major discipline by providing the tools and knowledge required for technical (i.e. business-to-business) sales careers. The objectives of the minor are to provide a broad understanding of the technical sales process, and it includes courses from both the College of Engineering and the College of Business. In addition to their engineering background, graduates with this minor will have the skills necessary to calculate a return on investment, develop a client value analysis, formulate bid strategies and complete other essential sales-related tasks.

Nondestructive Evaluation Minor

Students at ISU have a unique opportunity to get a multi-disciplinary qualification in the rapidly evolving engineering discipline of Nondestructive Evaluation. Nondestructive evaluation (NDE) utilizes a number of techniques to determine the health of an engineering component or structure without affecting its usefulness. Much like a doctor may use ultrasound or radiography to assess the health of the body, engineers use these and other techniques to decide if material properties are within an acceptable range, if a component was well manufactured, or if damage has occurred in service that would warrant retirement. NDE professionals are active in all phases of engineering, from design to manufacturing to in-service use, and in all industry sectors including aviation, power generation, transportation, manufacturing, and many others. Students make use of the state-of-the-art equipment and expertise of the Center for Nondestructive Evaluation, a National Science Foundation Industry/University Cooperative Research Center.

Nuclear Engineering Minor

The Nuclear Engineering Minor allows undergraduate engineering students with a fundamental knowledge of nuclear sciences and engineering thus enabling them to pursue employment in any one of a number of fields associated with using penetrating radiation. The minor prepares students for careers designing radiation techniques to diagnose and combat cancer, contributing to national security, developing advanced radiation sources and detectors for use in scientific research, and working with advanced nuclear energy systems. The minor involves a combination of coursework at Iowa State and online classes offered by the Big 12 Engineering Consortium. The curriculum includes course in nuclear radiation theory and engineering; radiation detection, measurement, protection and shielding; probabilistic risk assessment; and nuclear reactor theory and analysis.

Interdisciplinary Minors Open to Engineering Students

Entrepreneurial Studies Minor

Entrepreneurial Studies is an interdisciplinary program that provides opportunities to students to learn about entrepreneurship. The goal of the Entrepreneurial Studies program is to provide the knowledge and skills needed to create value through recognizing and developing opportunities. In addition to feasibility analysis and business planning, the program deals with the topics of innovation, opportunity recognition, technology transfer, industry analysis, and competitive strategy.

Sustainability Studies Minor

The interdisciplinary minor in Sustainability exposes students to ideas and issues related to a sustainable, balanced, and ethical future for the planet and its inhabitants. The minor focuses on the interplay between environmental, social, and economic factors in improving the quality of human life within the capacity of supporting ecosystems. Graduates with this minor understand the dynamics of biological population growth and decline in the natural world, predator-prey models, over-exploitation of natural resources, energy balances, and much more. Graduates also understand how human behavior affects the natural world and why some environmental, social, and economic profiles are sustainable and others are not.

Wind Energy Minor

The Wind Energy minor is primarily intended for students majoring in engineering or meteorology, but will be available to all that meet the prerequisites. Wind energy is a pivotal component of our nation's future energy portfolio, particularly given the desire to reduce the carbon footprint through the use of renewables. The Minor provides graduates with a broad understanding of the wind energy industry from component design and manufacturing, electric generation, transmission, and grid operations, to policy.

Interdepartmental Graduate Programs

Bioinformatics and Computational Biology (PhD)

The bioinformatics and computational biology major is one of the largest such PhD programs in the nation, both in terms of students and faculty strength and diversity of research. Students have the opportunity to conduct research in all major research areas of computational molecular biology, including genomics, structural genomics, functional genomics, and computational systems biology. Students train in a highly interdisciplinary environment under faculty with expertise spanning both computational and life sciences, with access to some of the most modern experimental platforms. Several engineering faculty are actively involved in the program. [CBE, ECpE, MSE]

Biorenewable Resources and Technology (MS, PhD)

This first in the nation graduate program in biorenewable resources and technology (BRT) offers students advanced study in the use of plant- and crop-based resources in the production of biobased products (fuels, chemicals, materials, and energy). This multidisciplinary program offers minor and co-major MS and PhD degrees. The BRT program also offers a 12-credit hour online graduate certificate that provides students from a wide variety of science and engineering backgrounds an exposure to advanced study in biorenewables. [ABE, CBE, CCEE, ME]

Engineering Management (MEng)

The Engineering Management Program prepares engineers for leadership/management positions within their organizations. The program gives students the knowledge and skills necessary to manage and develop a highly qualified and trained staff of engineers, scientists, and technicians in a rapidly changing technological environment. Engineering Management is a unique discipline that uses engineering skills and knowledge in managing large scale projects. [All]

Environmental Science (MS, PhD)

The environmental science major provides a technically rigorous, quantitative, and integrated approach to the study of environmental systems. Given the magnitude and complexity of our environmental problems, there is a growing need for graduates trained in the integrated analysis of environmental systems. The environmental science curriculum is designed to prepare students for positions of leadership in this rapidly changing field. In addition to work in their chosen area of specialization, students are afforded a broad exposure to the biological, chemical, and physical aspects of environmental systems and the specialized training necessary for integrated analyses of these systems. [ABE, CCEE]

Executive Engineer Dual Master's Degree Program (MEng + MBA)

The College of Engineering and the University of Iowa's Henry B. Tippie School of Management offer an Executive Engineer Dual Master's Degree Program especially created for mid- to upper-level engineering managers and executives like you. Graduates earn two degrees — a master of engineering in systems engineering (MEng) from Iowa State and a master of business administration (MBA) from Iowa.

Human-Computer Interaction (MS, PhD)

Driven by unprecedented technological progress, the relationship between humans and increasingly powerful, portable, interconnected, and ubiquitous computers is fast becoming one of the most dynamic and significant fields of technical investigation. With more than 60 researchers, representing all the colleges in the university, Iowa State is expanding its focus to become a leader in HCI research. [AerE, ABE, CCEE, ECpE, IMSE, ME]

Information Assurance (MS)

The Information Assurance Program prepares highly-qualified engineers, computer science experts, and information systems professionals for information security and assurance careers. The Iowa State program is designed to fill the current and future need for information security and assurance professionals to support the nation's information infrastructure. Information assurance has become a critical issue for businesses as they encounter problems from external network attacks as well as internal issues due to lax control systems and compliance requirements. This program leads to a multidisciplinary degree supported by six departments from three Iowa State colleges. These are: Computer Science; Electrical and Computer Engineering; Industrial and Manufacturing Systems Engineering; Logistics, Operations and Management Information Systems; Mathematics; and Political Science. Iowa State University is recognized as one of the Centers of Academic Excellence in Information Assurance education. [ECpE, IMSE]

Sustainable Agriculture (MS, PhD)

Students in the Graduate Program for Sustainable Agriculture study agroecological principles and the social relations underlying sustainable farming and food systems while gaining practical experience with

sustainable production methods. The program seeks to balance depth in disciplinary knowledge with broader, systems-level thinking. It integrates the technical and social sciences through a sequence of team-taught interdisciplinary courses emphasizing higher-order critical thinking skills and active, collaborative approaches to learning. Students choose classes from six cross-disciplinary areas to complement their core training. [ABE]

Systems Engineering (MEng) – Administered by the IMSE Department

The Systems Engineering Program is designed to enable engineers, regardless of undergraduate discipline, to develop the analytical abilities needed to design, evaluate, and build complex systems involving many components and demanding specifications. This program is designed to train engineers to excel in the technology driven design environment commonly found in developing modern complex engineered systems. The intent of this program is to extend the ability of engineers to work across disciplinary boundaries as needed. [IMSE]

Toxicology (MS, PhD)

The Toxicology Program emphasizes interdisciplinary education and training. Faculty expertise and laboratory facilities are available in the areas of analytical chemistry, animal and avian protection, aquatic toxicology, bacterial toxins, behavioral toxicology, biochemical toxicology, bioremediation, biotransformation of toxicants, cancer research, cellular toxicology, developmental toxicology, drug metabolism, endocrine disrupters, environmental chemistry, food safety, forensic toxicology, groundwater and aquatic risk, insect toxicology, instrumental analysis, molecular and genetic toxicology, mycotoxins, neurotoxicology, nutritional toxicology, animal odor and emission analysis, parasitology, pesticide research, plant pathology, regulatory toxicology, reproductive toxicology, retinoids, teratogenicity, and veterinary toxicology. [ABE, CBE]

Transportation (MS)

The perspective of many disciplines is needed to solve the complex questions facing transportation systems today, and students come to Iowa State's interdisciplinary program in transportation with backgrounds as varied as the program itself. This diversity enriches the academic experience, allowing students to see the strength of interdisciplinary approaches to planning, operating, managing, and maintaining the next generation of transportation systems. [CCEE]

Wind Energy Science (PhD)

This program is an interdisciplinary PhD program that prepares graduates for wind energy related careers in industry, academia, and government institutions. The primary objective is to develop students' capability to conduct successful research on interdisciplinary problems that occur in wind energy. This is achieved through a unique integration of engineering, science, and policy-related disciplines including education and research activities. [AeroE, CCEE, ECpE, IMSE, MSE, ME]

Engineering Related Technical Majors

College of Agriculture and Life Sciences

Agricultural Systems Technology (BS) – Administered by the ABE Department

Agricultural Systems Technology (AST) graduates focus on managing, using, and troubleshooting technology by applying their knowledge of technology, agriculture, and processing systems. The hands-on curriculum in the College of Agriculture and Life Sciences teaches students to manage machines and equipment, biological processes, computers and other technologies to create new and improved agricultural systems for the future. Students majoring in Agricultural Systems Technology choose between two options:

- Agricultural and Biosystems Management
- Machine Systems

Industrial Technology (BS) – Administered by the ABE Department

The Industrial Technology curriculum blends comprehensive general education courses and extensive laboratory experience with manufacturing processes. Strong emphasis is placed on computer applications, resource allocation, safety, and product quality. The following options permit students to specialize in subject areas:

- The **Manufacturing** option prepares graduates to plan and coordinate materials, machines, methods, and human resources in a manufacturing environment.
- The **Occupational Safety** option prepares graduates to develop, coordinate, and evaluate the safety issues relating to people, materials, equipment, methods, and environments.

Industrial and Agricultural Technology (MS, PhD) – Administered by the ABE Department

Industrial and Agricultural Technology is a MS and PhD graduate program that focuses on technology systems for industry, agricultural, and public sectors. The PhD program focuses on preparing the next generation of faculty for a broad sector of technology related disciplines.

College of Liberal Arts and Sciences

Computer Science (BS, MS, PhD)

Computer science majors are prepared for a career in the computer and information sciences industry. They are provided with a strong background in the fundamentals of computing, algorithms, programming, languages, databases, computer systems, and software engineering. Computer science majors often explore advanced topics in several areas including artificial intelligence, machine learning, robotics, databases, information systems, and parallel & distributed computing.

To learn more about the differences among Computer Engineering, Electrical Engineering, Software Engineering and Computer Science see this [information sheet](#).

Links to the ISU Catalog

- College of Engineering Section: <http://catalog.iastate.edu/collegeofengineering/>
- Basic Program for Professional Engineering Curricula: <http://catalog.iastate.edu/collegeofengineering/#basicprogramcurriculatext>
- Four-Year Plans for Engineering Majors: <http://catalog.iastate.edu/planofstudy/engineering/>