SCHOOL OF ENGINEERING

A Message from the Dean

Welcome to the School of Engineering at Fairfield University. We are devoted to serving students as they successfully pursue undergraduate and graduate engineering degrees. The School provides opportunities for students to combine study with experience and professional practice through classroom instruction and industrial internships, offering the prospect for the best in engineering education.

The School of Engineering strives to maintain the highest level of instructional integrity, and remains committed to the Ignatian ideals of education, finding bigger answers to society's problems, and providing service to socially and economically disadvantaged populations.
In pursuit of this mission, we are committed to expanding student engagement in the engineering professions. The School's graduates will have mastered theoretical and practical knowledge of engineering skills, and will have strong foundational knowledge in communications, critical judgment, social responsibility, economics and ethics to use in building their professional careers.

On our website, you will find an explicit description of the educational objectives of each of the engineering programs offered in the School of Engineering. The curricula and degree requirements are linked to the objectives through student learning outcomes leading to national accreditation. The engineering curricula includes perhaps the most purposeful liberal arts core in the nation - the hallmark of Fairfield's education - that aim to transform our students into thinking citizens and lifelong learners, and prepare them to live an inspired life. Additionally, our ambition in the School of Engineering is to enable all our students to assume positions of technical leadership and professional responsibility, and to achieve full satisfaction in their jobs, or in graduate studies, upon graduation from Fairfield University

On behalf of the entire School of Engineering, welcome!

Bruce W. Berdanier, Ph.D., PE, PS
Dean, School of Engineering

School Overview

Vision

As an integral component of a comprehensive Jesuit university, the School of Engineering is committed to providing a student-oriented classroom and laboratory environment enhanced by research that enables graduates to become leaders in the quest to solve society's greatest challenges in service to others.

Mission

The Fairfield University School of Engineering is dedicated to providing quality educational opportunities in engineering and computer science to a diverse student population. The School emphasizes whole-person development (*cura personalis*) through its commitment to a unique integration of expertise in innovative technical areas with a strong liberal arts core preparing graduates well for professional practice and graduate education.

Values

The Fairfield University School of Engineering is devoted to the success of its students. This commitment is seen in the school's dedication to teaching and mentoring provided by faculty, staff and student peers. Through our Ignatian pedagogy, School of Engineering students are constantly challenged to reflect, analyze, and ask "why" as they seek bigger answers to address local and global issues.

Mentoring

Entering and continuing students meet with academic advisors to design jointly their schedule of courses. Students review their academic records before course registration each semester with assistance from advisors to keep abreast of their progress. The school provides counseling to students upon request so that their academic goals can be achieved efficiently and economically. Department chairs and program directors are actively involved in student advising and mentoring. Practicing engineers are often invited to participate in mentoring of interdisciplinary teams in the final senior design project.

Tutoring

Out-of-classroom assistance, provided by engineering professionals, and peer tutors is available in the school's tutorial center on a daily basis and a peer led content mastery program in foundational courses began in 2014. A schedule of tutorial/mentoring services is distributed to all students in the beginning of each term.

Facilities

The offices of the School of Engineering, along with classrooms, primary laboratory and computer facilities are located in the Bannow Science Center. The engineering reference and circulating collection is housed in the University's DiMenna-Nyselius Library. The School's laboratories are equipped with modern instrumentation and are improved annually with financial assistance of the university, the alumni and private foundations. In order to provide an environment for experiential learning that is closely integrated with classroom learning, the School of Engineering laboratories provide the capability for demonstration of phenomena, simulation of processes, measurements, and data management. Finally, a growing number of engineering courses are offered online as needed. The School's website, fairfield.edu/soe (https://www.fairfield.edu/undergraduate/academics/schools-and-colleges/school-of-engineering), offers information on the School, its programs, courses, and faculty.

Transfer Admission

General Transfer

Students with previous studies at other accredited institutions may apply for transfer to the School of Engineering. Credit for work completed elsewhere, with a grade of C or better, will be granted for equivalent Fairfield courses, in accordance with Fairfield University guidelines. The transfer student must provide an official transcript of all academic work and a catalog with course descriptions from each institution previously attended.

Transfer from Community Colleges

The School of Engineering has articulation agreements with the Connecticut College of Technology embracing the 12 community colleges in Connecticut. Under this agreement, the B.S. degree completion by graduates of community colleges with an engineering associate's degree is greatly facilitated at Fairfield University. Bridge courses to facilitate transfer, and some financial aid to transfers from community colleges, are also offered by the School of Engineering.

School Activities/Relationships with Area Industry

Engineering students at Fairfield University may join the Engineering Student Society, an umbrella organization that embraces student chapters of the American Society of Mechanical Engineers, Society of Automotive Engineers, the Institute of Electrical and Electronics Engineers, and the Society of Women Engineers. Students are encouraged to join ESS and profit from events sponsored by the chapters. Engineering students initiated an Engineers Without Borders student chapter in 2015.

The School of Engineering maintains direct relations with area industries and manufacturers. Students are encouraged to post their resumes on the University's Career Development site, fairfield.edu/stags4hire (https://fairfield-csm.symplicity.com/employers/?signin_tab=0&PHPSESSID=046f98d35d637bb3bbe584a362667e6a), and to visit the site often to check for jobs and internships. These open lines of communication encourage the flow of information and support that keeps the engineering curriculum current and relevant to the environment in industry. These contacts are particularly useful to students in the senior design project course where they tackle real-life engineering problems encountered by practicing engineers and become involved in the mainstream of engineering activity.

School of Engineering Advisory Board

The School of Engineering (SOE) receives philanthropic support and strategic guidance from the SOE Advisory Board, a group of men and women in leading positions in industry and education. Additionally, each program area in the SOE receives program development guidance from its program advisory board.

Degrees

Bachelor of Science

The School of Engineering offers undergraduate programs leading to the Bachelor of Science in the following fields:

- Bioengineering (https://catalog.fairfield.edu/undergraduate/engineering/bioengineering)
- Computer Engineering (https://catalog.fairfield.edu/undergraduate/engineering/electrical-computer-engineering/bs-computer-engineering)
- Computer Science (https://catalog.fairfield.edu/undergraduate/engineering/computer-science-software-engineering/bs-computer-science)
- Electrical Engineering (https://catalog.fairfield.edu/undergraduate/engineering/electrical-computer-engineering/bs-electrical-engineering)
- Mechanical Engineering (https://catalog.fairfield.edu/undergraduate/engineering/mechanical-engineering)
- Software Engineering (https://catalog.fairfield.edu/undergraduate/engineering/computer-science-software-engineering/abet-accredited-bs-software-engineering)

Students in these programs complete 132 to 134 credit hours. Students begin their studies with EG 0031 Fundamentals of Engineering I and complete the degree requirements with the team-based Senior Design Project. EG 0031 is designed to introduce first-year students to important design elements and the tools of engineering and develop their skills in analysis and synthesis, and in teamwork. It further provides the basis for students to select the engineering discipline most suitable to their skills and career objectives. The Senior Design Project caps students' engineering education by implementing engineering design principles and associated skills in designing for functionality, reliability, sustainability and economy in real-world projects undertaken by multidisciplinary teams. All engineering programs include experiential learning in laboratory courses and culminate with the Senior Design Project. Students can avail themselves of opportunities for independent study and for internships in local industry. The undergraduate curriculum may be completed as a full-time traditional 4-year program or part time.

Part-Time Program

This program allows fully employed students to pursue engineering degrees on a part-time basis at a pace suited to their circumstances. Many employers provide tuition reimbursement. The curriculum requirements for the BS degrees through this program are the same as those for the full-time traditional programs. Engineering courses are available through evening and hybrid study courses. Advanced engineering classes, offered in the evening, are subscribed by both full-time and part-time students.

Core Curriculum

The general education core curriculum provides a liberal education, drawing upon four major areas of knowledge. For each of these four areas of competency, Engineering majors select courses as noted in each of the major sections of this catalog.

Diversity Requirements

All full-time and part-time students must complete one U.S. Diversity and one World Diversity course from a designated list of courses.

Major Areas of Study

Specific program objectives and curriculum requirements are provided in the sections that follow each engineering discipline. In general, the curricula consist of four areas:

- major field requirements
- major field electives
- general education core curriculum courses
- general electives

Concentration within Majors

Within each major field of study there are specialized options that can be taken to fulfill special career plans, under advisement from the department chair. Numerous elective courses afford opportunities for students to gain deeper knowledge and skills in areas of their interest. For example, microelectronics, power electronics, or wireless communications would be areas of concentration in electrical engineering; signal processing, digital design, or computer graphics in computer engineering; databases, data warehousing and data mining, or networks and network programming, in software engineering; and strength of materials or machine design in mechanical engineering.

Minors in Other Fields of Study

Engineering students are eligible for a mathematics minor with the completion of five mathematics courses. It should be noted that all engineering programs require five, or more, mathematics courses. In addition, engineering majors can opt to fulfill the requirements for other minors. For example, an engineering student who wishes to gain further knowledge in economics could use the two social science electives and

the two general electives in the liberal arts core, and with one summer course, he/she will complete the requirements for an economics minor. Similar arrangements can be made for a business minor or a physics minor.

Minor in Engineering

The School of Engineering offers a minor in engineering for non-engineering students. This is a 14-credit hour course of study for students who have completed two courses in calculus and two in physics with a grade of C or better. Four engineering courses of three credits each, and two laboratory courses of one credit each, are required for the completion of the minor. Students who choose the engineering minor will benefit intellectually from exploring the field of engineering and will strengthen their candidacy for professional studies such as medicine or law.

An 18-credit minor in Computer Science is also available, see the Computer Science (https://catalog.fairfield.edu/undergraduate/engineering/computer-science-software-engineering/computer-science-minor) section for details.

University Honors Program

The School of Engineering participates in the University Honors Program (https://catalog.fairfield.edu/undergraduate/arts-sciences/honors-program), an interdisciplinary course of study (23 credits) open to invited freshmen and sophomores and devoted to intellectual history, interdisciplinary studies, and advanced work in the student's major field.

Five-Year Pathways to Bachelor's and Master's Degrees

- Electrical and Computer Engineering Five-Year Dual-Degree Program (https://catalog.fairfield.edu/undergraduate/engineering/electrical-computer-engineering/electrical-computer-engineering-five-year-dual-degree-bs-ms)
- Management of Technology Five-Year Dual-Degree Program (https://catalog.fairfield.edu/undergraduate/engineering/mot/five-year-mot-program)
- Mechanical Engineering Five-Year Dual-Degree Program (https://catalog.fairfield.edu/undergraduate/engineering/mechanical-engineering/mechanical-engineering-five-year-dual-degree-bsms)
- Software Engineering Five-Year Dual-Degree Program (https://catalog.fairfield.edu/undergraduate/engineering/computer-science-software-engineering/dual-degree-curriculum)

A master's degree in engineering is becoming more commonly seen as the entry level degree in the workplace. A master's level engineering education gives a great return on your investment as well as a more focused and satisfying career.

Students can now complete a five-year pathway to both BS and MS degrees in Electrical and Computer Engineering, Mechanical Engineering, and Software Engineering. Additionally, in five years, students can also complete a BS degree in any of the undergraduate engineering programs followed by an MS in Management of Technology. Typically students should meet with their advisor during their junior year and complete detailed planning for the specific requirements for the bachelors and masters degrees that they are interested in. All of the five-year pathways require a minimum of 3.0 GPA along with approval from the faculty advisor.

Courses

General Engineering

EG 0031 Fundamentals of Engineering I **3 Credits**
Prerequisite: PS 0115*.
This course provides core engineering knowledge and competencies in a highly interactive class format. Topics include professional skills such as technical writing and presentation, guidelines for professional engineering practice, and career preparation. Introduction to the fields, roles, and industries of engineering also serves as a basis for selection of engineering major field. Hands-on team projects are core learning experiences. They form a structured introduction to the implementation of principles of design and engineering methodologies, system engineering management, and presentation skills. Guest presenters and field trips augment this course, which is taught by interdisciplinary faculty teams. (*indicates concurrency allowed)

EG 0060 STEM of Guitar **3 Credits**
Fee: $250 Engineering Lab Fee
This course looks at the design elements, manufacturing and assembly of solid-body electric guitars. Science, technology, engineering, and mathematics (STEM) concepts that relate directly to guitars are used to help students make an applied learning connection. Each student will construct their own electric guitar. Course will cover wood species and the environment, guitar headstock design features, chemistry of finishes, math applications in a guitar, physical science aspects of the guitar such as mechanical systems, concepts of sound waves, string tension, fretboard layout, intonation, and electronics. Studio-style class, lecture and lab time combined throughout course. The $250 lab fee applies to cover materials.

EG 0130 Engineering Graphics I **3 Credits**
This is a basic course in engineering graphics principles and is taught simultaneously with SolidWorks, a 3D modeling design application. Using traditional and computer design, the course stresses geometric constructions, orthographic projection, dimensioning, sectional views, 3D part modeling, assembly modeling, drafting and engineering drawings, animation and geometric tolerancing. The course stresses aesthetics and technical sketching. You will gain a working knowledge of SolidWorks in engineering design. Course requires a computer that runs Microsoft Windows. Formerly CD 0211.

EG 0145 Mathematical Analysis **3 Credits**
Attributes: EVAP Environmental Studies: Applied Professional Skills
Corequisites: EG 0145P, MA 0146.
Prerequisite: MA 0145.
In this course students will learn mathematical and numerical methods such as differentiation, integration, and Fourier analysis and how to apply these methods to solve scientific problems. Additionally, the course will cover statistics including data analysis, trend fitting, datacorrelation, and interpolation. Students will learn to use MATLAB as a tool but also become proficient in programming.

EG 0145P Mathematical Analysis PLG **0 Credits**

EG 0210 Introduction to Nanoscience and Nanotechnology I 3 Credits
This course will provide a highly interdisciplinary introduction to the science of nanoscale materials (nanoscience). The course will survey the new field of nanoscience/nanotechnology, aiming to motivate interest in and heighten awareness of this field. Its many potential applications in medicine, biology, electronics and optoelectronics, engineering, materials science and chemistry, open a broad new horizon to an exciting technology to serve societal needs. Topics will include historical background, characterization techniques, physics and chemistry of nanoscale materials, fabrication techniques, characterization methods, nanoscale applications (nanotechnology), and ethical/societal considerations.

EG 0260 Robots 3 Credits
Prerequisite: PS 0115.
Introductory course in robotics develops understanding of how robotic systems integrate sensors, actuators, and control systems to achieve specific goals. Principles of autonomy, programming, wireless communications, sensor applications, mechatronics, electrical power, electric motors, pneumatics, structure, and locomotion will be understood and applied. Design of robotic subsystems will utilize multiple areas of knowledge. The course will involve application of statistical analysis to quantify robot performance. Service learning is an integral part of the course. All participants will participate in weekly mentoring of a youth robotics competition team to put into practice the principles learned in class, and to learn through community interaction from other students using robots to accomplish different feats.

EG 0300 Feedback Control Systems 3 Credits
Prerequisites: MA 0251, EE 0301.
This course emphasizes analysis and synthesis of closed loop control systems using both classical and state-space approaches with an emphasis on electro-mechanical systems. The mathematical requirements include the Laplace transform methods of solving differential equations, matrix algebra, and basic complex variables. The discussion of classical control system design includes the modeling of dynamic systems, block diagram representation, time and frequency domain methods, transient and steady state response, stability criteria, controller action [Proportional (P), proportional and integral (PI), Proportional, integral, and derivative (PID) and pseudo-derivatives feedback], root locus methods, the methods of Nyquist and Bode, and dynamics compensation techniques. The discussion of state-space methods includes formulation and solution (analytical and computer-based) of the state equations and pole-placement design. The course integrates the use of computer-aided analysis and design tools (MATLAB) so as to ensure relevance to the design of real world controlled electro-mechanical systems using case studies and applications to electrical and mechanical systems. Includes lab (hardware-based) exercises. Formerly MC 0300.

EG 0305 Design of Mechatronics Systems 3 Credits
Prerequisite: Senior standing.
This course covers development of mechatronics theory and applications to systems dependent upon the integration of mechanical, electrical and computer engineering. Students assemble hardware components to create a product design that fulfills a specified task in a mechatronics system. Students develop design skills in mechanisms, electrical devices, and software to create, test, and verify system function. Formerly MC 0305.

EG 0315 Engineering Applications of Numerical Methods 3 Credits
Prerequisite: CS 0131.
Topics include root-finding, interpolation, linear algebraic systems, numerical integration, numerical solution of ordinary and partial differential equations, modeling, simulation, initial boundary value problems, and two point boundary value problems. Formerly EG 0325.

EG 0330 Engineering Graphics II 3 Credits
This course introduces CATIA Version 5; the leading CAD/CAM/CAE application used by automotive, aerospace, shipbuilding, and consumer goods industries. It provides mechanical, electrical, automotive, aerospace, and marine engineers and architects with the design tools to take products from concept to completion - in one seamless application. This course covers basic solid modeling concepts of individual sheetmetal and machined parts from detailed drawings. "Complex Shape Modeling" using "wireframe concepts" and "surface-based" modeling is covered. Building of assemblies of components and control of their positioning and orientation, as well as motion simulation is covered. Fully detailed production drawings of components and assemblies are also covered. Formerly CD 0212.

EG 0350 Advanced Programmable Logic Control (PLC) Systems 3 Credits
Prerequisites: PS 0116, MA 0245.
This course will give students advanced concepts in programmable logic controllers and their applications and interfacing to industrial controls in the areas of automation, manufacturing, and others. Topics include bit operations, data manipulation, industrial PLC network utilizing Ethernet, ControlNet, and DeviceNet. Data sharing and distributed PLC programming techniques along with fundamentals of touch panel programming and operation are studied. State of the art software used: MultiSim, LabView, Cosivis, Veep, Automation Studio, and RS Logix 500. It will include also: input/output ports, intermittent and continuous process control, arithmetic and comparison instruction, function block diagrams, indirect and indexed addressing, and sequential function charts. The course will consist of: lectures, group discussions, case studies, a term project, and computer simulation. Formerly MF 0350.

EG 0360 Engineering Project Management 3 Credits
Attributes: HASM Humanitarian Action Minor Skills/Method Course
This course concentrates on the general methodology of managing an engineering project from concept to operational use with emphasis on the functions, roles, and responsibilities of the project manager. Study of the basic principles and techniques related to controlling resources (i.e. people, materials, equipment, contractors, and cash flow) to complete a project on time and within budget while meeting the stated technical requirements. Through group and individual activities, including case study review and field work, students will learn to apply project management tools and techniques. The course will be taught by teaching each phase of project management as we complete the relevant aspects of the project in the field. There will be some classroom time for introducing concepts, and planning. However, the majority of time each day will be spent in the field executing the project, putting into practice the phases of project management. The course will prepare students with the ability to learn the necessary background information and hands-on technical skills, to be flexible and adaptable in difficult environments. These skills will be valuable in many areas, particularly in the planning and execution of humanitarian action and engineering in developing countries. Enrollment by permission only. Students must be able to study abroad.

EG 0390 Senior Design Project I **3 Credits**

Prerequisite: Completion of all non-elective program courses; completion of other program requirements to enable graduation within the year of completion of EG 0391.

In this capstone course, students work in teams on advanced projects that emphasize engineering design with due attention to design constraints and engineering standards. The overarching scope of this course is to transform engineering students to practicing engineers. Under the guidance of a faculty instructor and a mentor, each team conducts literature searches, write a technical proposal and its members develop skills in information analysis and synthesis; they model and test prototypes of their devices, and make frequent oral and poster presentations of their work to faculty and peers, and submit timely progress reports. In the process, they receive instruction in effective communication and presentation practices, and develop an appreciation of teamwork and collective success. This two-semester course begins in the fall of the academic year and concludes at the end of the spring term with a final team oral presentation and a final written report, and a working prototype of the team's project. It also includes sample hardware fabrication in the machine laboratory.

EG 0391 Senior Design Project II **3 Credits**

Prerequisite: EG 0390.

In this capstone course, students work in teams on advanced projects that emphasize engineering design with due attention to design constraints and engineering standards. The overarching scope of this course is to transform engineering students to practicing engineers. Under the guidance of a faculty instructor and a mentor, each team conducts literature searches, write a technical proposal and its members develop skills in information analysis and synthesis; they model and test prototypes of their devices, and make frequent oral and poster presentations of their work to faculty and peers, and submit timely progress reports. In the process, they receive instruction in effective communication and presentation practices, and develop an appreciation of teamwork and collective success. This two-semester course begins in the fall of the academic year and concludes at the end of the spring term with a final team oral presentation and a final written report, and a working prototype of the team's project. It also includes sample hardware fabrication in the machine laboratory.

EG 0398 Internship **1-3 Credits**

EG 0399 Independent Study **1-4 Credits**

Other Subjects

Consult the pages for each department for courses in the following fields:

- Bioengineering (https://catalog.fairfield.edu/undergraduate/engineering/bioengineering)
- Computer Science and Software Engineering (https://catalog.fairfield.edu/undergraduate/engineering/computer-science-software-engineering)
- Electrical and Computer Engineering (https://catalog.fairfield.edu/undergraduate/engineering/electrical-computer-engineering)
- Mechanical Engineering (https://catalog.fairfield.edu/undergraduate/engineering/mechanical-engineering)