ELECTRICAL AND COMPUTER ENGINEERING

B.S., M.S., Ph.D. Degrees, Graduate Certificate

The mission of the UAF Electrical and Computer Engineering Department is to offer the highest-quality contemporary education at the undergraduate and graduate levels and to perform research appropriate to the technical needs of the state of Alaska, the nation and the world. The curriculum is designed to ensure that fundamentals and specialized skills are acquired by the student. Our programs prepare engineering graduates to enter practice and provide the theoretical background for students entering graduate studies.

Electrical and computer engineers design and develop electrical, electronic, control and computing systems for a wide range of technologies in a variety of engineering and other fields, including aerospace, automotive, biomedical, communications, electric utility, environmental, forensics, renewable energy, resource extraction, robotics, space systems, transportation and finance. An electrical engineering degree also opens the door to opportunities in business, law and medical fields, as well as for graduate work in engineering.

Graduates of our programs find rewarding employment in and outside of Alaska after graduation, with some even forming their own start-ups. Our graduates are sought after by companies, consulting firms and government agencies that require the specialized skills of electrical and computer engineers with practical training in the specific areas mentioned above and engineering in extreme environments. A few notable companies that hire our graduates include Agilent, BAE, Boeing, GCI, General Dynamics, IBM, Lockheed Martin, MathWorks, Microsoft, Power Engineers and a number of large and small electric utilities. Federal agencies and national laboratories that hire our graduates include the FAA, JPL, LANL, NASA, NIST, NREL and NSA. Some of our graduates go on to graduate programs at UAF and other well-known universities within and outside the U.S.

Undergraduate research and design project opportunities are available at UAF in the areas of embedded systems, wireless sensor networks, wireless and wired communications, unmanned aeronautical systems, space systems engineering, waves and space physics, electrical power systems and drives, renewable energy, microgrids and engineering in extreme environments. UAF's location just 200 miles south of the Arctic Circle—as well as the only university-affiliated rocket range in the country at Poker Flat, one of six FAA centers for unmanned aeronautical systems research, and a power systems integration laboratory that fully emulates a remote microgrid—provide a world-class environment and facilities for research related to auroral activity, remote sensing, microgrids and engineering in extreme environments. These programs offer real engineering experience as well as fellowships, paid internships and scholarships.

College of Engineering and Mines
Department of Electrical Engineering (http://cem.uaf.edu/ece/) & Computer Engineering (http://cem.uaf.edu/ece/)
907-474-7137

B.S., COMPUTER ENGINEERING

The BSCpE program at UAF provides the solid foundation and fundamental understanding necessary to succeed in a world of rapidly changing technology. Students gain knowledge and receive practical hands-on experience in computer architecture and systems design, electronic and digital circuits, embedded systems and wired and wireless communications systems. The program prepares engineering graduates to enter practice and provides the theoretical background for students entering graduate studies.

Computer engineering is a discipline that includes hardware and software design and provides a deep understanding of their interrelationship. It combines electrical engineering fundamentals, like microelectronics, electrical circuits and devices, digital signal processing, network design, communications systems, computer architecture, hardware design and systems analysis, with computer science concepts, including algorithms, software, graphics and artificial intelligence. Computer engineers design, analyze, produce, operate, program and maintain computer and digital systems. They apply theories and principles of science and mathematics to the design of hardware, software, networks and processes to solve technical problems. Most importantly, they understand how the hardware affects the software and vice versa.

Over the past decades, computers have evolved into complex systems that may consist of single machines or many interconnected computers linked by a data network. In one form or another, computers now control telephone and communications systems, process control and manufacturing automation systems, financial technology systems, management information systems, augmented reality systems and biomedical devices. They are in household appliances, automobiles, transportation systems and our pockets, and they're on our wrists. To work in the constantly evolving discipline of computer systems engineering, the computer engineer must acquire competence in both digital computer hardware and the fundamentals of software engineering.

Careers in computer engineering are as wide and varied as computer systems themselves. Systems range from embedded computer systems found in consumer products or medical devices to control systems for automobiles, aircraft and trains, and to more wide-ranging applications in telecommunications, financial transactions and information systems.

Within a few years of graduation, graduates of the UAF B.S. in computer engineering program are expected to:

1. Function independently and in diverse multidisciplinary teams as technically proficient, productive and ethically responsible members of their profession.
2. Apply their fundamental understanding, acquire and apply new knowledge and skills and allocate resources to solve real-world problems, including engineering for extreme environments.
3. Effectively communicate with technical and non-technical audiences, including employers, colleagues, clients, professional organizations and the public.

These objectives serve the department, college and university missions by ensuring that all graduates of the BSCpE program have received a high-quality, contemporary education that prepares them for rewarding careers in computer engineering.

The Computer Engineering Program is accredited by the Engineering Accreditation Commission of ABET (https://www.uaf.edu/cem/about/accreditation.php).

Candidates for the B.S. degree are also required to take the State of Alaska Fundamentals of Engineering Examination in their general field, which is the first step toward professional engineering licensure.

For more information about the computer engineering program's mission, goals and educational objectives, visit the College of Engineering and Mines accreditation website (https://www.uaf.edu/cem/about/accreditation.php).

Minimum Requirements for Computer Engineering Bachelor's Degree: 127 credits

Learn more about the bachelor's degree in computer engineering (https://uaf.edu/academics/programs/bachelors/computer-engineering.php), including an overview of the program, career opportunities and more.

B.S., ELECTRICAL ENGINEERING

The BSEE program at UAF provides the solid foundation and fundamental understanding necessary to succeed in a world of rapidly changing technology, while also providing the flexibility to explore specialization areas of electrical and computer engineering. Students gain knowledge and receive practical hands-on experience in wireless and wired telecommunications, electromagnetics, electric power generation, transmission and distribution, electric machines and drives, control systems and embedded systems. Elective courses in these areas allow a student to specialize in their degree program. The program prepares engineering graduates to enter practice and provides the theoretical background for students entering graduate studies.

Graduates of our program find rewarding employment in and outside of Alaska after graduation, with some even forming their own start-ups. Our graduates are sought after by companies, consulting firms, and government agencies that require the specialized skills of electrical and computer engineers with practical training in the specific areas mentioned above and engineering in extreme environments. A few notable companies that hire our graduates include Agilent, BAE, Boeing, GCI, General Dynamics, IBM, Lockheed Martin, MathWorks, Microsoft, Power Engineers, and a number of large and small electric utilities. Federal agencies and national laboratories that hire our graduates include the FAA, JPL, LANL, NASA, NIST, NSA, and NREL. Some of our graduates go on to graduate programs at UAF and other well-known universities within and outside the US.

Within a few years of graduation, graduates of the UAF B.S. in Electrical Engineering program are expected to:

1. Function independently and in diverse multidisciplinary teams as technically proficient, productive, and ethically responsible members of their profession.
2. Apply their fundamental understanding, acquire and apply new knowledge and skills, and allocate resources to solve real-world problems, including engineering for extreme environments.
3. Effectively communicate with technical and non-technical audiences, including employers, colleagues, clients, professional organizations, and the public.

These objectives serve the department, college, and university missions by ensuring that all graduates of the BSEE program have received a high-quality, contemporary education that prepares them for rewarding careers in electrical engineering.

The Electrical Engineering Program is accredited by the Engineering Accreditation Commission of ABET (https://www.uaf.edu/cem/about/accreditation.php).

Candidates for the B.S. degree are also required to take the State of Alaska Fundamentals of Engineering Examination in their general field, which is the first step toward professional engineering licensure.

For more information about the computer engineering program's mission, goals and educational objectives, visit the College of Engineering and Mines accreditation website (https://www.uaf.edu/cem/about/accreditation.php).

Minimum Requirements for Electrical Engineering Bachelor's Degree: 125 credits

Learn more about the bachelor's degree in electrical engineering (https://uaf.edu/academics/programs/bachelors/electrical-engineering.php), including an overview of the program, career opportunities and more.

M.S., ELECTRICAL ENGINEERING

The M.S. degree includes three options: a written thesis and oral defense for students interested in research and development; a project; or a coursework-only option. UAF offers an engineering Ph.D. program for students with an approved curriculum. Capable students with undergraduate degrees in physics, mathematics or related sciences, as well as in various branches of engineering, may also be admitted for graduate study. A student with an adequate background can usually complete M.S. requirements within two years and a Ph.D. in another three years.

Graduate degree programs in electrical and computer engineering are closely connected with faculty research activities. The main areas of research include communications, radar, lidar and sonar remote sensing, instrumentation and microwave circuit design, electric power and energy systems, digital and computer engineering, nanotechnology, controls and robotics. Current research topics include high-latitude satellite communications, rocket telemetry, radio wave propagation, ultra-wide-band wireless communications, electromagnetic and acoustic wave propagation, remote biomedical and environmental instrumentation, microwave design, digital signal processing, digital and physical electronics, computer applications, remote microgrids, alternative energy and energy storage, energy distribution management and optimization, power electronics, power system stability and quality improvement, energy storage, computer-controlled systems, control theory, robotics and automation.

A number of on- and off-campus research facilities are available to students. Satellite, rocket and ground-based communication studies are carried out on campus and at Poker Flat Research Range, the only university-operated rocket range in the world. The Space Systems Engineering Laboratory provides students with hands-on experience in all aspects of space system engineering through a design/build/launch paradigm applied to balloon and rocket payloads as well as small satellites. The Alaska Center for Unmanned Aircraft Systems Integration affords opportunities to work with drones and other UAVs. Department research laboratories include microwave, wireless communications, ultra-wide-band technology, waves, power electronics/robotics, instrumentation and digital laboratories. Research opportunities in electric power and energy systems and power electronics also exist in collaboration with the Alaska Center for Energy and Power.

Alaska's environment and remote location provide unique opportunities for research, such as the use of acoustic, light and radio wave techniques for measuring fish in Alaska rivers to the geophysical properties of the aurora borealis. Remote sensing for biomedical (animal tracking) and environmental (groundwater and air monitoring) applications is an important research area for Alaska. Electric power systems research includes issues related to isolated rural Alaska communities, analysis of larger interconnected generation, transmission and distribution systems serving major Alaska population centers and the use of alternative energy and energy storage systems.

Graduate students in electrical and computer engineering at UAF receive the highest quality contemporary education available at the graduate level and perform research appropriate to the technical needs of Alaska, the nation and the world.

Minimum Requirements for Electrical Engineering Master's Degree: 32 credits

PH.D., ENGINEERING

Engineers use knowledge of the mathematical and natural sciences to develop economical uses of materials and forces of nature for human benefit. The professional practice of engineering requires sophisticated skills, the use of judgment and the exercise of discretion. The basic education necessary for the professional practice of engineering is provided by the engineering bachelor's and master's degrees. Doctoral-level education requires independent research that generates fundamental advances in technology and discovers new knowledge for the benefit of society. Engineering Ph.D. degrees provide leadership in scientific research, academia and industrial research and development. The Ph.D. degree in engineering draws on the combined strength of the College of Engineering and Mines and offers opportunities for engineers at other UA campuses to participate.

Minimum Requirements for Engineering Doctoral Degree: 36 credits

GRADUATE CERTIFICATE, SYSTEMS ENGINEERING/ PROGRAM MANAGEMENT

This program provides graduate students the opportunity to focus a portion of their studies on the discipline of systems engineering/program management (SE/PM) and to highlight this specialization on their academic transcripts.

Minimum Requirements for Systems Engineering/Program Management Graduate Certificate: 12 credits

Programs
Degrees

- B.S., Aerospace Engineering (https://catalog.uaf.edu/bachelors/aerospace-engineering-bs/)
- B.S., Computer Engineering (https://catalog.uaf.edu/bachelors/computer-engineering-bs/)
- B.S., Electrical Engineering (https://catalog.uaf.edu/bachelors/electrical-engineering-bs/)
- M.S., Electrical Engineering (https://catalog.uaf.edu/masters/electrical-engineering/)
- Ph.D., Engineering (https://catalog.uaf.edu/phd/engineering/)

Graduate Certificates

- Graduate Certificate, Aerospace Engineering (https://catalog.uaf.edu/graduate-certificates/aerospace-engineering/)
- Graduate Certificate, Systems Engineering/Program Management (https://catalog.uaf.edu/graduate-certificates/systems-engineering-program-management/)

Minor

- Minor, Aerospace Engineering (https://catalog.uaf.edu/minors/aerospace-engineering/)