



SCHOOL OF  
**ELECTRICAL AND  
COMPUTER ENGINEERING**  
College of Engineering, Architecture and Technology

**ELECTRICAL  
ENGINEERING**

**COMPUTER  
ENGINEERING**

**COMPUTER  
SCIENCE**

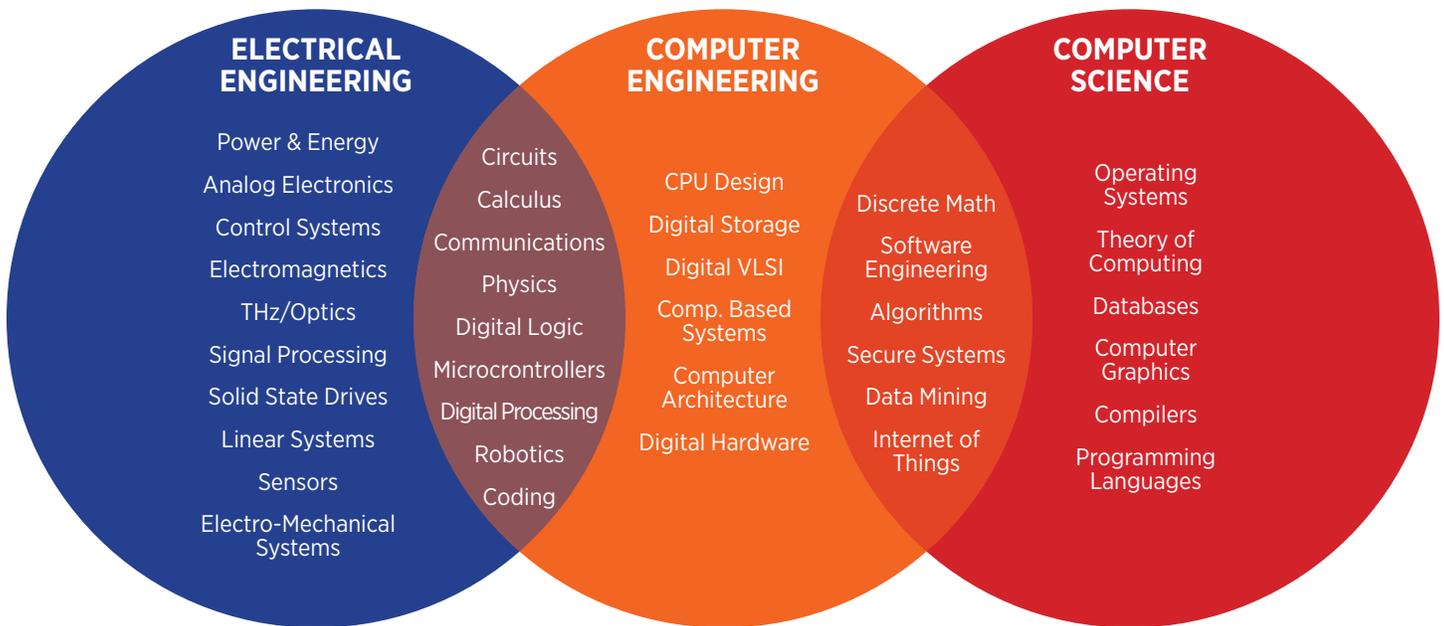
**SCHOOL OF ELECTRICAL & COMPUTER ENGINEERING**

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# DIFFERENCES BETWEEN ELECTRICAL ENGINEERING, COMPUTER ENGINEERING, SOFTWARE ENGINEERING AND COMPUTER SCIENCE

A common question that is frequently asked is “what is the difference between electrical engineering, computer engineering, software engineering and computer science?” Before this question is answered directly, consider the following preliminary comments:

- There are no hard boundaries between the fields of electrical engineering, computer engineering, software engineering, and computer science. It is not uncommon for electrical engineers or computer scientists to perform some of the tasks of a computer engineer and vice-versa. However, it is uncommon for a computer scientist to do the task of an electrical engineer.
- Different people will give different answers depending how narrow or how encompassing one defines the fields of electrical engineering, computer engineering, software engineering and computer science.
- Since the computer is so ubiquitous in our society, it is not uncommon for many non-computer engineers and non-computer scientists (e.g., mechanical engineers, mathematicians, physicists, etc.) to have a high degree of expertise with the utilization and application of computers in their profession.

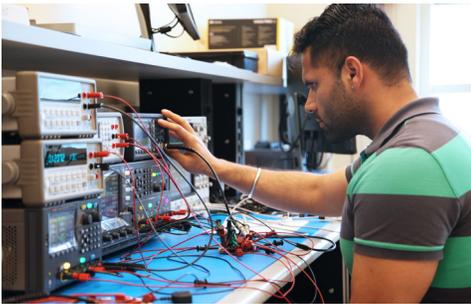


To answer the question more directly, it is helpful to use the graphic shown above. The graphic is by no means perfect in detail, but it does help to establish the big picture by classifying each profession by topics common to the profession. As one can see there is considerable overlap between electrical engineering and computer engineering, and between computer engineering and computer science, with no overlap between electrical engineering and computer science.

Both electrical engineers and computer engineers rely heavily on mathematical principles of calculus and the scientific theories of physics. Electrical engineers know the basics of computer engineering and computer engineers know the basics of electrical engineering. However, computer engineers have an in-depth understating of how the computer works, how it is designed, and how it is used with less interest in the broader topics of electrical engineering

(e.g., motors, wireless communications, amplifier design, antennas, etc.). One could say that computer engineers are electrical engineers who have an in-depth understanding and knowledge of computer-related technologies.

Computer engineers and computer scientists are both interested in computer software development and security. Discrete mathematics is critical to both professions. However, the break between the two disciplines occurs at the physical level when contemplating the physics and the electrical operation of the computer. The typical computer scientist is not interested in things like digital logic design, electronic switching circuits, VLSI multi-layer layout, embedded control, computer architecture, etc. That is, the computer scientist is quite removed from the volts, amps, and watts of a computer (i.e., the electrical properties of the computer).

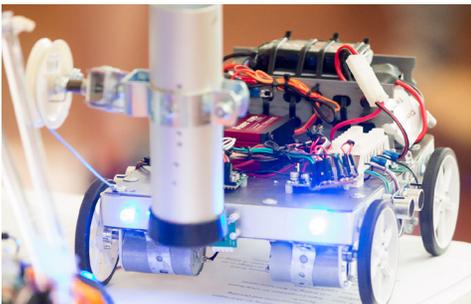


## ELECTRICAL ENGINEERING

Electrical engineering is a mature, broad-based profession that deals with all things associated with electricity, magnetism, and optics. The list of topics within electrical engineering is virtually infinite, given how central electricity is to a modern society. Electrical engineering encompasses many exciting subdisciplines including energy systems, machines, power electronics, analog electronics, digital electronics, mixed-signal electronics, VLSI chips, instrumentation, sensors, signal processing, machine

vision, artificial intelligence, communications, control systems, robotics, wireless devices, antennas, photonics, embedded controllers, networking, software development, lasers, biomedical devices, and computer architecture. The OSU School of Electrical and Computer Engineering encompasses all of these subdisciplines in its curriculum or research activities.

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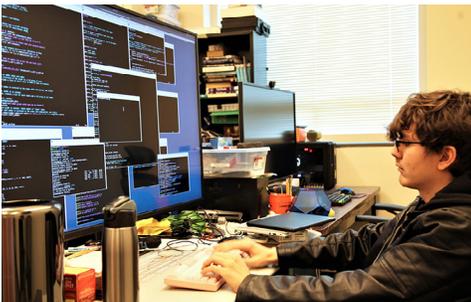


## COMPUTER ENGINEERING

Computer Engineering is a relatively young engineering discipline that combines a strong foundation in electrical engineering with elements of computer science, including hardware and software integration, and design. Computer engineering topics include digital logic circuits and systems, computer architecture, central processing units, graphical processing units, memory architectures, solid state drives, digital data communications, computer and sensor interfacing,

microprocessors, embedded control, digital control, VLSI circuits and systems, coding, software systems, and computer arithmetic.

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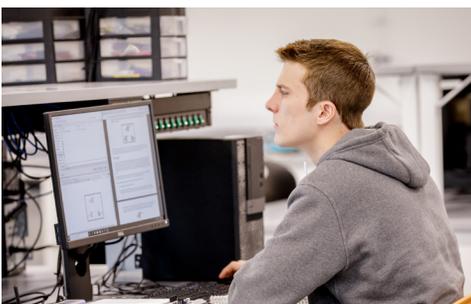


## SOFTWARE ENGINEERING

Software engineering is the compromise between computer engineering and computer science. The software engineer is a computer engineer who has chosen to focus more on software applications with a particular emphasis on the hardware-software interface. Applications include command and control of systems (e.g., robotics), data acquisition and analytics (e.g., artificial intelligence), cybersecurity, edge computing, cloud computing, GPU and FPGA programming, etc. The software

engineer tends to be less focused on computer circuit design (as in the case of the computer engineer) and less focused on the operating system (as in the case of the computer scientist). They develop, troubleshoot, maintain and document highly sophisticated code for diverse applications.

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## COMPUTER SCIENCE

Computer Science is typically interested in the “soft” aspects of computing such as operating systems, database management, computer graphics, computer languages, data structures, computing algorithms, and numerical computation. The “hard” aspects of the computer such as the physical and electrical operation of the computer are typically not within the domain of computer science.

The OSU School of Electrical and Computer Engineering (ECE), which is part of the College of Engineering, Architecture and Technology (CEAT), offers ABET-accredited baccalaureate degrees in electrical engineering and computer engineering. (The OSU Department of Computer Science (CS), which is part of the College of Arts and Science, offers a baccalaureate degree in computer science.) An ABET-accredited program is nationally recognized by industry and other universities as being of sufficient quality to prepare students for the engineering profession. Specifically, per ABET, “Graduates from an ABET-accredited program have a solid educational foundation and are capable of leading the way in innovation, emerging technologies, and in anticipating the welfare and safety needs of the public.” ABET designation assures students, parents, and future employers alike that the ABET program has been rigorously reviewed by a group of trained professionals and deemed to have sufficient resources and a sound curriculum to prepare students for a professional career.

Within ECE, the computer engineering program and the electrical engineering program share a common curriculum of freshman, sophomore, and most junior-level courses. A primary difference between the two is found in the senior year in which computer engineering students are required to take three ECE courses in computer engineering, whereas electrical engineering students are offered the option to take a wide variety of courses that span the broad discipline of electrical engineering. Another difference is found in the required computer science courses. Computer engineers are required to take six computer science courses; electrical engineers are required to take two.

It is quite usual for students to feel confused or conflicted coming into ECE about their choice between electrical engineering and computer engineering. Many students forego that choice by dual majoring in both, which is possible within the School of Electrical and Computer Engineering. To do so, such students fulfill all the requirements of the computer engineering program and then take twelve additional credit-hours of non-computer, electrical engineering courses. They emerge out of college with considerable knowledge and capability for their first entry-level job, ready to take on a wide variety of important tasks and duties in both the fields of electrical engineering and computer engineering.

Students who want a single degree but are unsure whether to choose electrical engineering or computer engineering are advised to select either computer engineering or electrical engineering as a freshman. Given many of the commonalities between the electrical engineering and computer engineering curriculum in the freshman, sophomore, and junior years, it is always possible to switch from one degree to another at a future date after one has sampled computer and electrical engineering topics in lower division courses. (Caveat: Switching from one degree program to another program late in one’s academic career may delay graduation.)

Students who want to become computer engineers, but have a strong interest in software can enroll in the Software Engineering Option. This 12 credit hour option is satisfied by taking 3 additional credit hours beyond the computer engineering degree program and utilizing 9 credit hours of technical electives for software engineering specific courses. In effect, the Software Engineering Option gives students the best compromise between computer engineering and computer science.

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## GUIDANCE IS AVAILABLE

The School of Electrical and Computer Engineering recognizes that life-long career decisions that a high school student or a non-traditional student face can be overwhelming. However, we have highly trained advisors and recruiters who are available to answer your questions and to inform you of the options that are available in our School. The following options are currently available:

- Bachelor of Science in Electrical Engineering
- Bachelor of Science in Computer Engineering
- Bachelor of Science in Computer Engineering with Software Engineering Option
- Dual Degree in Electrical Engineering and Computer Engineering
- Accelerated “4+1” Bachelor of Science and Master of Engineering in Electrical Engineering

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Please feel free to reach out to our academic advisers or recruiters by visiting <https://ceat.okstate.edu/ece/contact/index.html> and <https://ceat.okstate.edu/student-services/>.