What will I learn as an Computer Engineering student?

Department of Electrical and Computer Engineering

Tufts School of Engineering
Trying to decide on a major?

Most college course descriptions are full of technical terms that you can’t understand until after you’ve taken the course.

In the ECE Department, we thought it would be helpful to give you a casual description of our courses. That way you’ll know what you will be learning before taking the course.

If you are interested in Electrical Engineering, there’s another presentation for that major also.
Here is the basic layout for the BSCPE program. It’s 38 credits, just like the other engineering degrees at Tufts.

Courses like math and physics are all pretty much the same for all of the programs. So we’ll skip these.
The arrows show you which courses you should take first, so you can see the courses logically flow from one to the next.

There are also two free electives and many options for a minor.

We’ll step you through the courses that are specialized to electrical and computer engineering now.

Just click!
Key: → prerequisite  - - > corequisite  note: 2 free electives are not shown
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Select one of several freshman electives including:

**EN-73 Music and the Art of Engineering**
This course explores the electrical and computer engineering field by looking at electronic musical instruments and the synthesis of sound. In the lab you will design and build electronic circuits, learn how the ear processes audio signals, and develop some experience using computers and MATLAB to synthesize sound. The next course in the sequence is ES-3.

**EN-74 Introductory Image Processing**
If you have ever used Photoshop and wondered what was behind all of those commands in the pull-down menus, this class is for you. We cover the basics of digital image processing from enhancing the contrast in an image to noise removal and image warping. As part of the course, you will learn the basics of the MATLAB computational environment, which is needed not only for the assignments in EN-74, but also throughout the electrical and computer engineering curriculum. A final project is also required allowing you to explore advanced topics in areas ranging from medical imaging to computational photography.

**EN-62 Engineering Entrepreneurship**
This course presents how an engineer discovers a problem and delivers a solution to the marketplace through a simulated high technology business venture. You will learn how to define a customer's problem, to understand the competing technologies, and to overcome market forces. Additional subjects include how to develop and protect intellectual property which is at the core of engineering entrepreneurship.
**ES-3 Introduction to Electrical Systems**

In this course, you will learn about electrical circuits and how simple electrical circuits are combined to create more complicated systems. In the lab, you will learn how to use electronic equipment such as oscilloscopes. The class project is to design and build an audio speaker. You will test the speaker’s frequency response using your own home-built audio amplifier interfaced with a computer in the lab. The following courses are EE-21 in which you will learn to work with several types of electronic devices such as transistors and ES-4 where you will learn about digital circuits.
People say that we are living in a digital world today. In this course, you will gain a fundamental understanding of what this digital world is all about. You will learn how digital logic gates can be put together to implement complex and useful functions. You will also learn how these same gates can be used to build the basic storage elements found in the memory of computers and microcontrollers. In the lab, you will use industry-standard software to simulate digital circuits, and will also get the chance to physically wire circuits to implement digital functions. Final projects in the past have included making a digital clock or designing and building video games such as Pong.
Even though most information is processed in the digital domain, analog circuits are critical for connecting the “real world” to many of today’s complex, high-performance gadgets. The signal picked up by the antenna on your cell phone or the sensor signal produced by accelerometers to activate air bags is only a few microvolts! These signals are distorted by noise and require both amplification and filtering. In this course you will learn how to design analog amplifiers and filters. You will also study the fundamental building block of all modern circuits – the transistor. You will learn the fundamentals of microfabrication technology and how to interconnect transistors in various configurations to build high-performance analog circuits.
EE-14 Microprocessor Architecture and Applications

The microprocessor is the “brain” of many systems in modern life, like gaming systems, smart phones, automotive systems, and medical monitoring systems. This course introduces how microprocessors actually work on the inside and how you program these useful little chips for many high-tech applications. Students will develop some electronic games and a traffic controller in the lab. After taking this course, you will be able to program microprocessors to control almost any kind of engineered system.
Ever listen to a scratchy old vinyl record or a noisy AM radio broadcast? Maybe not. That’s because digital signals—compared to analog signals—are much easier to transmit and less vulnerable to noise. With simple combinations of 0’s and 1’s, it is much easier to send a clear signal (digital TV) or to store accurate data (MP3). This course reveals the magic of digital circuit design, from introducing simple circuit elements to designing a complete digital system. You will learn how to use switches, transistors, and other methods to create digital systems, to minimize the cost of your hardware, and to improve the speed of digital systems.
Ever wonder how a touch screen works? Why does an iPhone4 drop calls when you hold the case the wrong way? This course extends your knowledge beyond Physics 12 so that you can understand and design very high speed electronics, compact yet effective antennae, and every other electronic device that we consider crucial to modern life. In this course you will learn about electricity and magnetism and how these basic physical principles are combined by engineers to create the technology that surrounds us. This course is a prerequisite to many senior-level courses such as microwave electronics, radar and antennas, and semiconductor devices.
EE-23 Linear Systems

This course presents how engineers use signals and systems to model real-world applications such as voice and data transmission, audio signals in digital devices, image processing, radar, and robotics. Specifically, you will learn how to analyze analog and digital signals, to understand how filters transform a noisy input signal into a clear output signal, and to create mathematical models that simulate real-world systems. You will gain the mathematical foundations necessary to take the subsequent courses in communication, image processing, controls, and robotics.
EE-31 Junior Design Project

Here's your chance to put everything that you've learned into practice. Work with your classmates to design and build a complex project using microcontrollers, sensors, amplifiers, filters and all the other things you've been studying. Examples of projects include designing and programming miniature robots that communicate and coordinate their actions to mimic the behavior of insects.
EE–104 Probabilistic Systems Analysis

From the noise in an electronic circuit to the time you will spend waiting in line for a ride at Disneyland, randomness is an inherent part of any engineered system. In this class, we focus on developing the basic analytical tools needed to model randomness across a range of application areas. Both discrete (e.g., number of parts produced until the next failure) as well as continuous (e.g., temperature on a random day) models of randomness are discussed. The class also covers basic statistical methods needed to characterize a random process or to make decisions when faced with uncertain data. While the course does make use of mathematics as the basis for modeling, applications are stressed rather than proofs. Students might select ES-56 or another approved Prob/Stat course.
EE-103 Introduction to VLSI Design

In this course, you will learn how to design and make digital chips like microprocessors. The course will teach you the computer-aided design (CAD) design cycle from conceptualizing the architecture to using state-of-the-art design tools to design the actual silicon layout. Students will gain valuable experience in building their own silicon chips through the course. The course will prepare you for a career as digital integrated circuit design engineer so that you can invent tomorrow’s hottest technologies.
EE-126 Computer Engineering

In this course, you will learn the basic principles needed to design tomorrow’s computers, including the integration of hardware and software. You will start by designing components for addition, subtraction, multiplication and division. The course then advances to superfast “pipeline” designs, input/output systems for moving data between the real world and the computer, and the design of cache memory systems to make the computer more cost-efficient and able to compute with much higher speeds.
Everybody complains about Windows, but almost nobody does anything about it. Here’s your chance! Take this course to learn about the software that manages all those fancy electronic chips, and then learn how to build a good, stable operating system.
EE-97 and EE-98 Senior Design Project

Engineers solve real-world problems. This is your opportunity to select an interesting project and to design a working prototype using your knowledge from all of the other electrical and computer engineering courses. You will learn how to scope a project to include the customer’s requirements, to make an impact on society, and to meet the challenges of introducing new technology in a globally changing world. The expertise gained in this course will be useful in your engineering career as you face challenging problems, leadership and ethical decisions, and managing projects from start to finish.
Concentration Electives

Once you are a senior, you will have a better idea which topics are most interesting to you. At this point, we offer a large number of Concentration Electives. Any Electrical or Computer Engineering courses can be selected. You might also choose an upper level computer science course or broaden your skill set with a course from another field of engineering. Advanced math and science courses are also recommended.

Here are a few examples of CompE concentration electives from within the department....
Freshmen

HASS
Math 32 → Phys 11
Math 36 → Phys 12
EN 2
EN-xx

Sophomores

HASS

Juniors

EE-129 Computer Communication Networks
Learn how data systems communicate with each other. Gain expertise in communications networking techniques: switching and broadcast networks, access protocols, local networks. You will investigate design issues and become familiar with current computer networking products. The course also covers computer communications architecture: hardware/software issues, protocols and architecture, layered approach and hierarchical approach.

Seniors

HASS
EE 103
EE 97
EE 98
3 - CompE Conc. Electives

Math 61
EE 21
EE 18
EE 23
EE 26
EE 31

ES 3
Chem 1
EE 14

EN 2
ES 2
ES 4

EE 128
EE 126

EE 129

EE 26
EE 18
EE 23
EE 31
Our ears and eyes are the ultimate receivers of information -- especially music, language and images. These “signals” can be captured, stored, modified, improved, transmitted and reproduced using digital signal-processing techniques. Think for a moment about how many digitally based products you use each day. Why are they so compact, dependable and convenient? What are their advantages and limitations? What can be done digitally that is not possible by other means? What does the digital future hold? This course will answer those questions and give you the basic ideas behind digital signal.
EE-133 Digital Image Processing

The processing and analysis of images and video is growing rapidly with the emergence of high resolution imaging devices. Whether you want to better quantify global climate change by using hyperspectral satellite image data or unlock the inner workings of the mind by fusing information from multiple modalities, fundamental methods in image processing play a crucial role.
EE-22 Electronics II

This is the second course in electronics for EE majors that will teach the art of transistor-based analog circuits. You will learn how to design and build power amplifiers for your guitar or to create your own wireless FM radio transmitter. The course will prepare you for a career as an integrated circuit design engineer. These ECE graduates are the people that invent chips for wireless devices such as cell phones and consumer electronics such as DVD players and ultrathin televisions.
EE-105 Feedback Control Systems

Ever wondered how the cruise-control system in an automobile works? Did you know that it’s very similar to the electronics that guide a space shuttle or a modern jet? In this course, we will study the design and analysis of many common control systems and learn how mathematics is used to understand these engineering systems. You will write some computer simulations and also conduct hands-on lab work to help you learn these concepts.
EE -107 Communication Systems I

This course discusses how engineers use analog and digital methods to transmit information. In particular, you will learn how our radios, televisions, and the Internet send and receive information. You will gain expertise in designing communication systems for both wire- and radio-wave applications.
So that’s a quick look at the program in computer engineering. Please download a degree sheet from the website to get all the details.

If you have any questions, please feel free to contact any faculty member or the department chair!

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