# ELECTRICAL ENGINEERING & COMPUTER SCIENCE

COURSE 6

## CONTACT

EECS Undergraduate Office, ug@eecs.mit.edu

## DESCRIPTION

Course 6 at MIT consists of electrical engineering, computer science, and artificial intelligence and decision-making, as well as combinations with other departments (Biology, Brain & Cognitive Sciences, Economics, and Urban Science and Planning).

**Electrical Engineering:** Electrical engineers undertake a broad range of activities, from developing sophisticated systems that combine sensing, electronics, and computation, to developing new electronic, magnetic, photonic, and quantum devices. Electrical engineers also develop systems to transducer, process, and control electrical power for everything from renewable energy systems to the electrical grid.

**Computer Science:** Computer scientists use computers to conceive, design, and test logical structures for solving problems with focuses on program efficiency and performance. Computer scientists often work as software engineers, building and maintaining complex systems. They may also work to develop control software, mobile applications, websites, and numerical analysis software.

**Artificial Intelligence and Decision-making:** Experts in this area, also called *AI engineers* or *machine learning engineers* or *data scientists*, use computers to collect data about phenomena in the world, train models for predicting or controlling the phenomena, and use these learned or analytical models inside software or hardware systems, or in human or automated decision processes.

## INSIDE COURSE 6

## INTRODUCTORY COURSES

6.100A
6.100L **Introduction to Computer Science Programming in Python**
Introduction to computer science and programming for students with little or no programming experience. Students develop skills to program and use computational techniques to solve problems. Topics include the notion of computation, Python, simple algorithms and data structures, testing and debugging, and algorithmic complexity. 6.100A is a half-semester, 6-unit subject for students with some programming experience. 6.100L is a full-semester, 9-unit subject aimed at students with no programming experience.

6.100B **Introduction to Computational Thinking and Data Science**
Provides an introduction to using computation to understand real-world phenomena. Topics include plotting, stochastic programs, probability and statistics, random walks, Monte Carlo simulations, modeling data, optimization problems, and clustering.

6.9080
(formerly 6.01) **Introduction to EECS via Robotics**
An integrated introduction to electrical engineering and computer science, taught using substantial laboratory experiments with mobile robots. Key issues in the design of engineered artifacts operating in the natural world: measuring and modeling system behaviors; assessing errors in sensors and effectors; specifying tasks; designing solutions based on analytical and computational models; planning, executing, and evaluating experimental tests of performance; refining models and designs. Issues addressed in the context of computer programs, control systems, probabilistic inference problems, circuits and transducers, which all play important roles in achieving robust operation of a large variety of engineered systems.

6.9010
(formerly 6.08) **Introduction to EECS via Interconnected Embedded Systems**
Introduction to embedded systems in the context of connected devices, wearables, and the "Internet of Things" (IoT). Topics include microcontrollers, energy utilization, algorithmic efficiency, interfacing with sensors, networking, cryptography, and local versus distributed computation. Students design, make, and program an Internet-connected wearable or handheld device. In the final project, student teams design and demo their own server-connected IoT system.

## COURSE 6-FRIENDLY UROP AREAS

Computer Science and Artificial Intelligence Laboratory (CSAIL)
Research Laboratory of Electronics (RLE)
Laboratory for Information and Decision Systems (LIDS)
Media Lab
Microsystems Technology Laboratories (MTL)
Institute for Data, Systems, Society (IDSS)
Lincoln Laboratory (LL)
Broad Institute (BR)

## GET INVOLVED WITH EECS

EECS Undergraduate Student Advisory Group (USAGE)
Electric Vehicle Team
Student Information Processing Board (SIPB)
VR/AR @ MIT

Robotics Team
MIT Formula SAE Team
MIT Solar Electric Vehicle Team
IEEE/ACM
HKN
Women in EECS

## SKILLS

### ELECTRICAL ENGINEERING

Proficiency in programming and familiarity with algorithms
Analyze and design analog and digital systems
Proficiency with designing and building real systems
Problem-solving and troubleshooting
Ability to work in interdisciplinary teams

### COMPUTER SCIENCE

Proficiency in programming languages
Familiarity with logic and discrete mathematics
Problem-solving and troubleshooting
Ability to work in interdisciplinary teams

### ARTIFICIAL INTELLIGENCE & DECISION-MAKING

Proficiency in programming and algorithms
Familiarity with probability, statistics, linear algebra
Problem formulation and model validation
Ability to work in interdisciplinary teams

## POSSIBLE FUTURE POSITIONS

### ELECTRICAL ENGINEERING

- **Digital designer/computer architect:** Design computational hardware from transistors to general-purpose processors to special-purpose digital circuits such as hardware accelerators.
- **Device engineer:** Employ knowledge of device physics and material properties to research, design, develop, and test new electronic, photonic, magnetic, and quantum devices.
- **Embedded systems engineer:** Envision and create systems combining electronics, sensing and computation for embedded applications such as consumer electronics, automotive applications, or healthcare.

### COMPUTER SCIENCE

- **Software engineer:** Some develop applications that allow people to do specific tasks on a computer or another device. Others develop the underlying systems that run the devices or that control networks.
- **Network systems and data communications analyst/specialist:** Plan, design, build, maintain, and test networks and other data communications systems.
- **Information security analyst:** Plan and carry out security measures to protect an organization’s computer networks and systems. Responsibilities are continually expanding as the number of cyberattacks increases.

### ARTIFICIAL INTELLIGENCE & DECISION-MAKING

- **AI engineer:** Design and implement learning and inference methods, build models using machine-learning software toolkits, train and validate models.
- **Data scientist:** Formulate prediction problem, gather and clean data, validate resulting models, study impact of data sources and problem formulation on ethical deployment of system.
- **Roboticist:** Design and program physical robots for flexible manufacturing, handling merchandise in warehouses, automated driving.

## CAREER INDUSTRY EXAMPLES

Automation
App development
Circuits and systems
Cybersecurity
Data science
Laser and electro-optics
Magnetics
Medical technologies
Power electronics
RF communications
Robotics
Telecommunications
Ultrasonics

## SAMPLE EMPLOYERS

Amazon
Analog Devices
Apple
Boeing
Bose
Boston Dynamics
Citadel LLC
Formlabs
Google
iRobot
Lockheed Martin
Meta
McKinsey & Company
Microsoft
Vecna Robotics