EECS (Course 6) Subjects Recommended for Freshmen (2015)

Recommendations

The best (and most popular) choice to experience both EE and CS:
Take 6.01 in the Spring term. If you need to learn or practice Python programming beforehand, consider taking 6.0001 during the Fall term, or 6.149 or 6.177 during IAP.

If you’d like to dive into Electrical Engineering:
6.S197 is a hands-on introduction to EE designed to be taken in conjunction with 8.02 and 8.022.
If you have completed the Physics II GIR, you can take 6.03, 6.002, 6.004, or 6.007

If you’d like to dive into Computer Science:
If you have no programming experience, take 6.0001 and, if interested, follow up with 6.0002.
After completing 6.0001 or passing the 6.0001 advanced standing exam, take 6.S04 during the Spring 2016 term (6.S04 is not open to freshmen in Fall 2015).

If you’re interested in math:

If you want to take non-EECS courses but are worried about falling behind as an EECS major:
It works to wait until sophomore year to take your first EECS course although we recommend gaining experience in programming early in your career: it’s a useful skill for all scientists and engineers!

EECS subjects to consider during the term (☆ = can satisfy EECS requirement)

6.0001 Introduction to Computer Science Programming in Python (✫ , ★)
Prereq: None, Units: 2-3-1 (first half of term)

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.
Combination of 6.0001 and 6.0002 counts as a REST subject.

6.0002 Introduction to Computational Thinking and Data Science (✫, ★)
Prereq: 6.0001 or passing advanced standing exam, Unit: 2-3-1 (second half of term)

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. Combination of 6.0001 and 6.0002 counts as a REST subject.
**6.01 Introduction to EECS I**
Prereqs: Ability to program in Python, Coreq: Physics II (GIR), Units: 2-4-6

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. Combination of 6.01 with 6.02 or 6.03 counts as an Institute Lab. [If you need to learn Python, take 6.0001 during an earlier term, or 6.149 or 6.177 during IAP.]

**6.03 Introduction to EECS II from a Medical Technology Perspective**
Prereqs: Calculus II (GIR), Physics II (GIR), Units: 4-4-4

Explores biomedical signals generated from electrocardiograms, glucose detectors, and magnetic resonance images. Topics include physical characterization and modeling of systems in the time and frequency domains; analog and digital signals and noise; basic machine learning including decision trees, clustering, and classification; and introductory machine vision. Combination of 6.01 with 6.02 or 6.03 counts as an Institute Lab.

**6.504 Fundamentals of Programming**
Prereq: 6.0001 or advanced standing exam, Units: 4-4-4

Introduces fundamental concepts of programming. Designed to develop skills in applying basic methods from programming languages to abstract problems. Topics include programming and Python basics, computational concepts, software engineering, algorithmic techniques, data types, and recursion and tail recursion. Lab component will consist of software design, construction and implementation of design. Counts as an Institute Lab.

**6.07J Projects in Microscale Engineering for the Life Sciences**
Prereq: None, Units: 2-4-3

A project-based introduction to manipulating and characterizing cells and biological molecules using microfabricated tools. In the first half of the term, students perform laboratory exercises designed to introduce the design, manufacture, and use of microfluidic channels; techniques for sorting and manipulating cells and biomolecules; and making quantitative measurements using optical detection and fluorescent labeling. In the second half of the term, students work in small groups to design and test a microfluidic device to solve a real-world problem of their choosing. Includes exercises in written and oral communication and team building. Limited to 20; preference to freshmen.
★ 6.002 Circuits and Electronics ( † , ‡ )
Prereq: Physics II (GIR), Coreq: 18.03, Units: 4-0-8
Fundamentals of the lumped circuit abstraction. Resistive elements and networks, independent and dependent sources, switches and MOS devices, digital abstraction, amplifiers, and energy storage elements. Dynamics of first- and second-order networks; design in the time and frequency domains; analog and digital circuits and applications. Design exercises. Occasional laboratory.

★ 6.004 Computation Structures ( † , ‡ )
Prereq: Physics II (GIR), Units: 4-0-8
Introduces architecture of digital systems, emphasizing structural principles common to a wide range of technologies. Multilevel implementation strategies; definition of new primitives (e.g., gates, instructions, procedures, and processes) and their mechanization using lower-level elements. Analysis of potential concurrency; precedence constraints and performance measures; pipelined and multidimensional systems. Instruction set design issues; architectural support for contemporary software structures.

★ 6.007 Electromagnetic Energy: From Motors to Solar Cells ( † , ‡ )
Prereq: Physics II (GIR), Coreq: 18.03, Units: 5-1-6
Discusses applications of electromagnetic and equivalent quantum mechanical principles to classical and modern devices. Covers energy conversion and power flow in both macroscopic and quantum-scale electrical and electromechanical systems, including electric motors and generators, electric circuit elements, quantum tunneling structures and instruments. Studies photons as waves and particles and their interaction with matter in optoelectronic devices, including solar cells and displays.

★ 6.041 Probabilistic Systems Analysis ( † , ‡ ) ∁
Prereq: Calculus II (GIR), Units: 4-0-8

★ 6.042J Mathematics for Computer Science ( † , ‡ ) ∁
Prereq: Calculus I (GIR), Units: 4-0-8
Elementary discrete mathematics for computer science and engineering. Emphasis on mathematical definitions and proofs as well as on applicable methods. Topics: formal logic notation, proof methods; induction, well-ordering; sets, relations; elementary graph theory; integer congruences; asymptotic notation and growth of functions; permutations and combinations, counting principles; discrete probability. Further selected topics such as: recursive definition and structural induction; state machines and invariants; recurrences; generating functions. Counts as a REST subject.
6.050J Information, Entropy, and Computation (♀)
Prereq: Physics I (GIR), Units: 4-0-5

Explores the ultimate limits to communication and computation, with an emphasis on the physical nature of information and information processing. Topics include information and computation, digital signals, codes, and compression. Biological representations of information. Logic circuits, computer architectures, and algorithmic information. Noise, probability, and error correction. The concept of entropy applied to channel capacity and to the second law of thermodynamics. Reversible and irreversible operations and the physics of computation. Quantum computation.

6.070J Electronics Project Laboratory (♀)
Prereq: None, Units: 2-4-3

Intuition-based introduction to electronics, electronic components and test equipment such as oscilloscopes, meters (voltage, resistance inductance, capacitance, etc.), and signal generators. Emphasizes individual instruction and development of skills, such as soldering, assembly, and troubleshooting. Students design, build, and keep a small electronics project to put their new knowledge into practice. Intended for students with little or no previous background in electronics. Enrollment may be limited.

6.072J Introduction to Digital Electronics (♀, ♂)
Prereq: None, Units: 0-3-3 [P/D/F]

Design your own circuits for times when off-the-shelf solutions are not available. Seminar begins with assembly of a utility board. Weekly labs cover digital logic gates, memory elements, and finite-state machine design. Seminar concludes with a team-based design project. Preference given to freshmen. Maximum of 10 students per term, lottery at the first class session if oversubscribed.

✡ 6.5197 Practical Magic (♀)
Prereqs: 8.01, Coreq: Physics II (GIR), Units: 2-5-2

Provides students with the opportunity to experience the magical aspects of applying physics and machining to electrical product design. Students learn to use modern fabrication processes (laser cutting, thermoforming, and computer controlled machining) to construct systems using basic physics principles including resonance, conservation laws, and electromagnetic forces. Projects vary bi-weekly, but include analysis and construction of systems like audio speakers, laser range finders, timed rocket igniters, and optical instruments.
EECS subjects to consider during IAP

No more than 12 units of IAP credit can be taken. No IAP subjects satisfy any requirements for an EECS degree, although many of them provide very useful preparation for our required subjects. All Course 6 IAP subjects are P/D/F. Most IAP subjects are organized and taught by students.

6.057 Introduction to MATLAB, Units: 1-0-2
6.117 Introduction to Electrical Engineering Lab Skills, Units: 1-3-2
6.146 Mobile Autonomous Systems Laboratory: MASLAB, Units: 2-2-2
6.147 The BattleCode Programming Competition, Units: 2-0-4
6.148 Web Programming Competition, Units: 1-0-5
6.149 Introduction to Programming Using Python, Units: 3-0-3
6.151 iOS Game Design and Development Competition, Units: 2-2-2
6.176 Pokerbots Competition, Units: 1-0-5
6.177 Building Programming Experience in Python, Units: 1-0-5
6.178 Introduction to Software Engineering in Java, Units: 1-1-4
6.179 Introduction to C and C++, Units: 3-3-0

Questions?

If you or your advisor have any questions about EECS subjects, please contact the EECS Undergraduate Office (Room 38-476, ext. 3-7329, ug@eecs.mit.edu).