Carnegie Mellon

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www.ece.cmu.edu
Dear ECE Visitor:

Welcome to the Department of Electrical and Computer Engineering (ECE) at Carnegie Mellon. As you find your way through the corridors of our buildings, I would like to call your attention to some important information:

1. **ECE is the largest department within Carnegie Mellon’s engineering college, the Carnegie Institute of Technology.** In fact, ECE is one of the largest departments on the campus. ECE has over 80 faculty members, including research, adjunct, and courtesy faculty. The department serves about 450 undergraduate and approximately 300 graduate students.

2. **Exciting new research is taking place in ECE.** Cutting edge research areas include cyber-security, information processing and storage, and nano-enabled technologies. Many interdisciplinary research centers and laboratories have a home in the ECE Department; this booklet contains a section identifying them.

3. **The ECE Department collaborates with partners from academia and industry both locally and worldwide.** Although the majority of our work takes place on the Carnegie Mellon campus, our collaborations extend far beyond Pittsburgh. We are engaging in global collaborative research and teaching efforts through extension of our academic programs and research agreements.

We hope this booklet will provide a useful aid as you become familiar with the department. The directory of Hamerschlag Hall will guide you along your way. A section describing ECE undergraduate laboratories in Hamerschlag Hall provides a glimpse into the world of our undergraduates. The final section defining our many centers and laboratories will give you an idea of the range of our commitment to the field.

Happy touring!

T. E. Schlesinger
Professor and Head
ECE Department
Carnegie Mellon University
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Floor Plan for Hamerschlag Hall floors 1 through 3 and A through D. ECE has additional office and laboratory space in Roberts Engineering Hall, Porter Hall, and the Collaborative Innovation Center.
HH 1107 - ECE Undergraduate Computer Cluster

Students entering their sophomore year in ECE receive an account allowing access to cluster machines. Except when reserved for a class, this cluster is available to all ECE undergraduates. Students can log on to state-of-the-art machines in the cluster at the terminal or remotely. The computers are used for courses such as “Introduction to Computer Architecture,” “Analysis and Design of Digital Circuits,” and capstone design courses in analog and digital integrated circuits. Since these machines contain various industry-standard software packages, students do not have to purchase the software for some courses. Cluster computers also provide email, word processing, and presentation software for the preparation of lab reports and project presentations.

HH 1303 - Fundamentals of Computer Engineering Lab

In this required sophomore level course, 18-240, students work in pairs on four or five labs, each lasting from one to three weeks. The course introduces basic issues in design and verification of modern digital systems. Topics include Boolean algebra, digital number systems and computer arithmetic, combinational logic design and simplification, sequential logic design and optimization, register-transfer design of digital systems, basic processor organization and instruction set issues, assembly language programming and debugging, and a hardware description language. Students use computer-aided digital design software and actual hardware implementation laboratories to learn about real digital systems. They also write Verilog descriptions of circuits. Verilog is a hardware description language used to model logic hardware designs. Each student tests his or her description on a software simulator and finally downloads the description to the Altera field-programmable gate array (FPGA) board, transforming the device into a working hardware system.

HH 1305 - Fundamentals of Electrical Engineering Lab

This required sophomore-level course, 18-220, covers fundamental topics that are common to a wide variety of electrical engineering devices and systems. Topics include circuit analysis techniques, passive and active component modeling, operational amplifiers, energy storage elements, power analysis, time-response of first and second-order systems, sinusoidal steady-state response, frequency domain analysis, and filters. Other topics may include diodes and transistors, basic noise analysis, transformers, pole-zero plotting, and analysis in the complex...
plane. The laboratories provide students with opportunities to build and operate circuits that address concepts covered in the lectures, including circuit and component modeling, amplifiers, filters, and signal detection and processing. Students work in pairs on approximately ten labs, each lasting one to two weeks. Each computer station contains a signal generator and an oscilloscope (used to capture measurements and print graphs). Students test their designs on protoboards; when their designs work according to specifications they build them on printed circuit boards.

**HH 1307 - Embedded Systems and Capstone Design Course Lab**

During the Fall semester, this room is used as the lab for a junior-level course in embedded systems. In the Spring, the room is shared by two capstone design courses. In these three courses students work in groups of three to five. The embedded systems course involves a series of labs emphasizing core embedded operating system functionality as well as control/debugging features such as timers, interrupts, serial communications, flash memory, device drivers and other components used in typical embedded applications. In the capstone design courses, students work on a semester-long project. They present design proposals, create timetables for accomplishing various milestones, and give class presentations detailing group and individual progress. Each group receives a reasonable budget for purchasing additional hardware components for their project. Students can access the room around the clock via keycards. Past projects have included face and speech recognition systems, music compression, and a wireless intercom system.

**HH A101 - Introduction to Electrical and Computer Engineering Lab**

Every department in the college offers an introduction to engineering course that provides a preview of further courses in that department. During the freshman year engineering students are required to take two introductory courses to help them choose a home department. The ECE Department’s introductory course, 18-100, provides fundamental skills in circuit analysis and digital design that serve as a foundation to future course work. In the lab, students are given an opportunity to better understand basic electrical components by constructing and testing an electromechanical system (i.e., a robot). While the robot lab is a challenging first-year design project, the course provides clear guidance at every step. Each week students construct a single component based on a circuit specification, then test it and consider how it operates when the values are changed.

**HH A104 - Signals and Systems Lab**

"Signals," as it is commonly abbreviated, represents one of the many breadth courses offered by the ECE Department. This junior-level course covers a broad area of study that includes digital communications, digital signal processing, and multimedia coding. "Signals" teaches students how to mathematically model a time-varying signal and ask questions about the effects of various transformations. During lab time, students write short computer programs that transform small example signals and speech waveforms. This activity provides useful insight into the application of course material to model real-world signals, such as audio synthesis in MP3 players.
ECE undergraduates have the opportunity to plan and conduct independent engineering research, development, or design projects, usually in concert with the research interests and programs of faculty members. The research centers in ECE identify some of the thrusts of research carried out by ECE faculty. In addition to participating in projects through these centers, ECE students take advantage of Carnegie Mellon's encouragement in interdisciplinary exploration and work with faculty in robotics, computer science, physics, and other disciplines throughout campus.

**Carnegie Mellon CyLab**  
[www.cylab.cmu.edu/](http://www.cylab.cmu.edu/)

With increased reliance on advanced information technology comes the need to make information systems more secure, trustworthy, sustainable, and available, in the face of both intentional attacks and accidental faults. Carnegie Mellon CyLab is a university-wide, multi-disciplinary initiative involving more than 200 faculty, students, and staff working closely with the CERT Coordination Center (CERT/CC), an internationally recognized center of internet security expertise.

**Center for Circuit & Systems Solutions (C2S2)**  
[http://c2s2.ece.cmu.edu/](http://c2s2.ece.cmu.edu/)

C2S2 develops long-range design solutions for next-generation circuits, systems built from circuits, and the software that runs on them. C2S2 is a consortium of America's best research universities funded jointly by the U.S. semiconductor industry MARCO Focus Center Research Program and the U.S. Department of Defense.

**Center for Silicon System Implementation (CSSI)**  
[www.ece.cmu.edu/~cssi/](http://www.ece.cmu.edu/~cssi/)

As system sizes head toward trillions of transistors, implementation of an electronic system in silicon must consider new forms of design regularity and structure simultaneously with advancement in design automation. CSSI, built from the infrastructure of the Center for
Electronic Design Automation established in 1982, has strong ties to national and international semiconductor, design, and electronic design automation industrial communities.

**Center for Wireless and Broadband Networking (CWBN)**  
www.ece.cmu.edu/~cwbn/

CWBN is an interdisciplinary center for research and education in advanced networking concepts and systems with an emphasis on industrial relevance. Founded in 2001, the Center builds on university strengths in interdisciplinary research, wireless networking, and optical devices and signal processing.

**Data Storage Systems Center (DSSC)**  
www.ece.cmu.edu/research/dssc/

DSSC is an interdisciplinary research and educational organization whose mission is to advance information storage technologies with a focus on materials, fabrication, devices, servo systems, signal processing, and coding. The Center works closely with industrial partners to define projects that will advance beyond the current frontiers of magnetic recording, optical data storage, probe based systems, holographic processes, and solid state memory.

**General Motors-Carnegie Mellon Collaborative Research Laboratory (GM/CM-CRL)**  
http://gm.web.cmu.edu/

The GM/CM-CRL is an interdisciplinary organization formed to foster close collaboration between General Motors and Carnegie Mellon researchers working toward making the automobile the next information technology platform in our society. The Lab’s work is broadly divided into the areas of design methodologies, wireless systems, reliable embedded systems, and human vehicle interfaces.

**Parallel Data Laboratory (PDL)**  
www.pdl.cmu.edu/

The PDL addresses a broad spectrum of data storage-related challenges including secure storage, emerging technologies, disk characterization and modeling, efficient storage access, storage networking, and network-attached storage clusters. Close ties with industry and the government agencies that have a critical need for these technologies is a hallmark of the PDL.
Advanced Mechatronics Laboratory (AML)
www-2.cs.cmu.edu/~aml/

Research in the AML focuses on the idea of rapidly deployable intelligent systems. The main threads of this research are composition, collaboration, task management, and adaptation. Past AML projects have been in distributed information systems, distributed robotics systems, distributed design systems, intelligent instruments, sensor-based robotics, reconfigurable systems, and adaptive software.

Computer Architecture Laboratory at Carnegie Mellon (CALCM)
www.ece.cmu.edu/~calcm/

CALCM brings together faculty and students from all branches of computer architecture including parallel architecture, reconfigurable architecture, low power architecture, and applications of parallel architecture in biotechnology.

Microelectromechanical Systems (MEMS) Laboratory
www.ece.cmu.edu/~mems/

The MEMS Laboratory is engaged in research on sensor and actuator systems that comprise mechanical features measuring in microns and components numbering from few to millions. Areas of interest include nanometer-scale data storage, microsensors and microactuators, MEMS design tools, micromechanical component modeling, embedded microinstruments, and microrobotics.
CARNEGIE MELLON STATEMENT OF ASSURANCE

Carnegie Mellon University does not discriminate and Carnegie Mellon University is required not to discriminate in admission, employment, or administration of its programs or activities on the basis of race, color, national origin, sex or handicap in violation of Title VI of the Civil Rights Act of 1964, Title IX of the Educational Amendments of 1972 and Section 504 of the Rehabilitation Act of 1973 or other federal, state, or local laws or executive orders.

In addition, Carnegie Mellon University does not discriminate in admission, employment or administration of its programs on the basis of religion, creed, ancestry, belief, age, veteran status, sexual orientation or in violation of federal, state, or local laws or executive orders. However, in the judgment of the Carnegie Mellon Human Relations Commission, the Department of Defense policy of, “Don’t ask, don’t tell, don’t pursue,” excludes openly gay, lesbian and bisexual students from receiving ROTC scholarships or serving in the military. Nevertheless, all ROTC classes at Carnegie Mellon University are available to all students.

Inquiries concerning application of these statements should be directed to the Provost, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA 15213, telephone (412) 268-6684 or the Vice President for Enrollment, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA 15213, telephone (412) 268-2056.


Carnegie Mellon University publishes an annual campus security report describing the university’s security, alcohol and drug, and sexual assault policies and containing statistics about the number and type of crimes committed on the campus during the preceding three years. You can obtain a copy by contacting the Carnegie Mellon Police Department at (412) 268-2323. The security report is available through the World Wide Web at http://www.cmu.edu/security/stats.html.