University of California at Berkeley
Dept of Electrical Engineering and Computer Sciences
Instructional Support Group
Electronics Support Group

EECS Instructional Facilities (for ABET Oct 2012)

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Content for:

ABET Self-Study Report (draft-eac-self-study-2012.docx, March 2012): "CRITERION 7. FACILITIES" table (p. 52-60)

References:

> ABET Self-Study Report (draft-eac-self-study-2012.docx, March 2012): "CRITERION 3. STUDENT OUTCOMES" (p 33)
> ABET Self-Study Report (draft-eac-self-study-2012.docx, March 2012): "CRITERION 5. CURRICULUM" table (p. 41+)
> EECS Undergraduate Notes (http://www.eecs.berkeley.edu/Programs/Notes): Chapter 2

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CRITERION 7. FACILITIES

A. Summarize each of the program's facilities in terms of their ability to support the attainment of the program
educational objectives and student outcomes and to provide an atmosphere conductive to learning.

1.  Offices (such as administrative, faculty, clerical, and teaching assistants) and any associated equipment
    that is typically available there.
...
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[Maybe Scott, Mark or Rosita could answer this.]

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CRITERION 7. FACILITIES

A. Summarize each of the program's facilities in terms of their ability to support the attainment of the program
educational objectives and student outcomes and to provide an atmosphere conductive to learning.
...
2.  Classrooms and associated equipment that is typically available where the program courses are taught.
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All classrooms on campus are capable of sound and video projection from a workstation or laptop for teaching purposes. In all classrooms, students can access the internet from their laptops via the campus wireless network. Some lectures are recorded for internet streaming and archiving. Classroom AV and seating resources are described in detail in http://registrar.berkeley.edu/Scheduling/attributes.html

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A. Summarize each of the program's facilities in terms of their ability to support the attainment of the program
educational objectives and student outcomes and to provide an atmosphere conductive to learning.
...
3. Laboratory facilities including those containing computers (describe available hardware and software) and the
associated tools and equipment that support instruction.
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The EECS Department has allocated approximately 10,000 sq ft to 17 laboratories in Cory, Soda and Sutardja Dai Halls for instructional computing and engineering courses. There is an overall ratio of 12 students per workstation in these laboratories.

Features that are common to all of the instructional laboratories include:

Physical Access: Most labs are open 24 hours, 7 days per week to students who have authorized cardkey access.

AV resources: All labs are capable of sound and video projection from a computer for teaching purposes. Some labs are recorded for use in WEB-based course materials.

Printing & scanning: All labs have access to printing from every computer. 17 networked printers are distributed amongst the labs. Several flatbed scanners and a slide scanner are available to the students.

Collaboration space: Areas in the labs are provided for laptop users (seating, table space, power, networking) and group collaboration.

Networked computers: We support 8 electronics laboratories, 9 computing laboratories and several related facilities in support of the EECS program educational objectives. Each lab has a networked computer at each station. The computers are running Windows, Linux, Solaris or MacOSX. The students login to their domain accounts and networked home directories, where they develop and store their portfolios of coursework throughout the semester.

Login servers: These servers are accessible by all students for programming and for running licensed application software:

2 Sun SPARC T5220 (8-core 1.2-GHz USPARC, 32 GB RAM) running Solaris 10
5 Sun SPARC V280 & V440 (1.1-GHz USIII, 8 GB RAM) running Solaris 10
2 Sun Fire X4600 (8-core Opteron 885, 32 GB RAM) running Solaris X86 in several virtual systems ("zones")
3 Dell servers (dual 2.8-GHz Xeon, 6-8 GB RAM) running Linux
26-node cluster (dual 2.8-GHz Xeon, 16-32 GB RAM) running Linux
4 Dell servers (dual 2.8-GHz Xeon, 6-8 GB RAM) running Windows Remote Desktop Server
1 SVN server

Software: Here are some major software applications that are available to all students for coursework in our labs. Most software is also accessible via remote login access to our compute servers.

- Adobe Creative Suite
- Cadence tools (Icfb, Virtuoso, ..)
- Eclipse
- Final Cut Pro, iMovie
- HSpice
- IAR
- ADS
- Java,C, C++
- Magick++
- Mathematica
- Matlab, Simulink (and dozens of toolkits)
- Maya
- Metrics
- Microsoft Visual Studio
- National Instruments LabView
- Perl, Python, PHP, Ruby on Rails
- Quanser QuaRCModelSIm
- SolidWorks
- Synopsys tools (Suprem4, TCAD, Medici, …)
- Virtutech Simics
- Xilinx, Virtex-5 FPGA

National Instruments, Abobe and Microsoft products are also licensed for use on students' personal computers.

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Here is a summary if the instructional facilities that are provided for each area of study:

Software & Languages

Typical Courses:
CS61A (Structure of Computer Programs)
CS61B (Data Structures)
CS61C (Machine Structures)
CS10 (Beauty of Computing)
CS9[ABCDEFGH] (self-paced computer languages)
CS161 (Computer Security)
CS162 (Operating Systems & System Programming)
CS164 (Programming Languages & Compilers)
CS169 (Software Engineering)

Facilities:
These classes have 7 computer labs (150 seats) and at least a dozen login servers for programming and software project development. The computers run Solaris, Linux, Windows and MacOSX. Departmental IT staffs provide customized servers and software as needed for specific assignments and for the instructors to run auto-grading programs.

The large core classes (CS61*, CS10) have reserved lab sessions with individual instruction. CS10 uses the BYOB language, which was developed from Logo by EECS faculty to teach the fundamentals of computer languages.

The design courses (CS162, CS164, CS169) have students working in multi-disciplinary teams on semester-long projects in language design and object-oriented programming.

CS61C and CS169 make innovative use of the Amazon EC2 cloud and VirtualBox virtual computers. The instructor provides base machine images that provide a standard programming environment.

User Interface Design, Graphics, Animation

Typical Courses:
CS160 (User Interface Design)
CS184 (Computer Graphics)
CS39A (Computer Animation)

Facilities:
MacPro Lab (200 SDH): This 30-seat lab is used for animation and for general programming assignments. CS39A and independent student projects use Maya and Renderman to author and render complex animations. CS160 uses XCode and the iPhone SDK for iPhone application design.

The design courses (CS160, CS184) use our labs and collaboration spaces for several group projects. CS184 students use software such as OpenGL, GLUT, Xcode and FreeImage on the operating system of their choice. CS160 uses a dedicated lab with Windows workstations to develop projects in Human Computer Interaction. Students design dynamic user interfaces using input devices such as the Microsoft Kinect and programming tools including the Kinect SDK, C+, OpenGL and OpenNI. The software is also available for the students' personal laptops at no cost to the students.

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Parallelism, HPC, Big Data

Typical Courses:
CS61A (Structure of Computer Programs)
CS61C (Machine Structures)
CS294-1 (Behavioral Data Mining)
CS194-15 (Engineering Parallel Software)

Facilities:
The Icluster: This 26-node cluster is available to classes and individual students studying parallel processing (MapReduce), high-performance computing (MPI) and large-scale data mining (MarkLogic).

Parallel Computing Lab (330 Soda): This lab has 28 Dell T5500 workstations with NVidia Tesla graphics co-processors. Students work in the lab as well as via remote access to the workstations. Classes run Matlab, the Intel ICC compiler and other compilers.

Computer Architecture, Embedded Systems

Typical Courses:
CS149 (Embedded Systems)
CS150 (Components & Design Techniques For Digital Systems)
CS152 (Computer Architecture & Engineering)
CS250 (VLSI Systems Design)

Facilities:
The design courses (CS149,CS150) have strong laboratory components, with emphasis on a semester-long sequence of projects. They use LabVIEW Embedded,Matlab Simulink/Stateflow with Real-Time Workshop, Xilinx, Virtex-5 FPGA, Microblaze and Visual Studio in dedicated hardware labs (125 Cory, 119 Cory, 204 Cory).

CS152 runs Virtutech Simics, a full-system machine simulator, on our Linux workstations (330 Soda) and servers.

CS250 runs Synopsys tools on our Linux cluster (The Icluster) and servers.

Computer Algorithms and Applications

Typical Courses:
CS170 (Efficient Algorithms & Intractable Problems)
CS172 (Computability & Complexity)
CS174 (Combinatorics & Discrete Probability)
CS186 (Database Systems)
CS188 (Artificial Intelligence)
CS191 (Quantum Computing)

Facilities:
The CS17* courses focus on algorithms, combinatorics, probability, specific problems, and how they relate to practical issues such as compiler design. CS191 is cross listed with Physics and Chemisty classes. Matlab and Mathematica are available on the EECS instructional computers for all students in these courses. Some assignments are done in C, C++ or Java, which are also available.

In the design course (CS186), students are given their own SQL server instances to modify and recompile. The course includes solo and team-oriented programming projects based on Ruby on Rails, and extensions to the PostgreSQL open-source database system.

In CS188, students write machine learning algorithms, typically in Python, that classify handwritten digits and photographs.

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EE core courses

Typical Courses: CS150 (Components and Design Techniques for Digital System...)
EE20N (Structure and Interpretation of Systems and Signals)
EE40 (Introduction to Microelectronic Circuits)
EE105 (Microelectronic Devices and Circuits)
EE117 (Electromagnetic Fields and Waves)

Facilities: 125 Cory: CS150 is a premier lab course based on a custom Xilinx XUP-505 FPGA board used in labs that lead to major design projects, such as a MIPS processor, a graphics processor, and multi-player games based on the 802.15.4. Tools include Xilinx ISE (Verilog entry, Chipscope debugging), Modelsim simulation, Synplify Pro for place and route, and CVS for group project version control.

105 Cory: EE20N students run LabVIEW and Matlab lab exercises for the mathematical modeling of signals and systems with applications to audio, images, video, communications, and control

140 Cory: EE40/43/100 students do a number of introductory lab experiments, leading to a month-long final group project. There are 24 lab stations (workstation, digital scope, power supply, ARB generator, multimeter) as well an NI MyDAQ and a Digilent Electronics Explorer PC based equipment.

353 Cory: EE105 students run experiments that include the characterization of diodes, BJT and BJT op amps, NMOS, impedance, gain, frequency response, cascade configuration, biasing, feedback, CMOS inverters, ring oscillators, and amplifiers. There are 15 lab stations (workstation, oscilloscope, ARB, power supply, multimeter, and Semiconductor Paramater Analyzer), and 6 additional stations with unique equipment, such as spectrum analyzers and high frequency sources. Software includes LabVIEW, SPICE, and Metrics.

111 Cory: EE117 students perform a number of lab exercises including distributed coupled elements, slotted line (SWR), pulse propagation and reflection, network analyzer singe stub tuning, hall effect, Faraday's law, Snell's law, and custom built antennas.

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Microelectronic Devices & Circuits

Typical Courses:

EE113 (Power Electronics)
EE119 (Introduction to Optical Engineering)
EE130 (Integrated-Circuit Devices)
EE131 (Semiconductor Electronics)
EE140 (Linear Integrated Circuits)
EE141 (Introduction to Digital Integrated Circuits)
EE142 (Integrated Circuits for Communication) the High Speed (900MHz) Analog Design lab course
EE143 (Microfabrication Technology)
EE144 (Introduction to Computer-Aided Design of Integrated Circuits)

Facilities:

CAD tools: Students in these classes run HSpice, Cadence, Synopsys and Matlab on our workstations and login servers. We also provide home editions for some of these products.

140 Cory: EE119 uses two optics tables and lasers, and the students perform a number of experiments focusing on design and application of optical systems.

353 Cory: EE140 is a discrete transistor analysis (HSPICE) and design lab course, typically with three labs, including single state MOSFET amplifier, discrete BJT op amps, and a CMOS op amp design.

125 Cory: EE141 is largely a software design lab course using Cadence and HSPICE tools for design, layout, and simulation of digital electronics circuits, meeting real world specifications.

111 Cory: EECS142 students model, design, simulate (ADS), build, and test filters, mixers, oscillators, and amplifiers. They also perform noise measurements, and perform modulation experiments using state of the art RF equipment (spectrum and network analyzers, vector signal generators, oscilloscopes, power supplies, SMT solder stations).

Microfab Facility (218 Cory): EE143 students use 8 stations, a wet lab and clean room to manufacture and analyze integrated circuits. EECS143 is a CMOS based practical wet lab course in which students design, process, and characterize basic semiconductor devices. Berkeley is one of the few universities offering such an experience at an undergraduate level. This is maintained jointly by instructional support staff and Nanolab research support staff.

Signals & Systems

Typical Courses:

EE120 (Signals and Systems)
EE121 (Introduction to Digital Communication Systems)
EE122 (Introduction to Communication Networks)
EE123 (Digital Signal Processing)
EE126 (Probability and Random Processes)
EE129 (Neural and Nonlinear Information Processing)
EEC145B (Image Processing and Reconstruction Tomography)
EEC149 (Introduction to Embedded Systems)

Facilities:

CAD tools: Students in these classes run HSpice, Cadence, Synopsys and Matlab on our workstations and login servers. We also provide home editions for some of these products.

105 Cory: EE120 students run LabVIEW and Matlab in this and other computer labs to do advanced mathematical modeling of complex systems, especially in the areas of communications and signal processing.

119 Cory: EEC149 students perform 7 set experiments, including LabVIEW, WiiMote interfacing, Xilinx Microblaze ADC configuration, iRobot Create hill climb (both VXWorks and Statecharts implementations), and a major final project. Recent projects used Kinect, Quadrotor, various optical components, as well as networked Android based controllers and robots.

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Robotics & Control

Typical Courses: EEC125 (Introduction to Robotics)
EEC128 (Feedback Control)

Facilities: 119 Cory: EEC125 students perform a planar two-joint arm MATLAB simulation, drive an iRobot Create, perform 3D object reconstruction, characterize accelerometers, perform a pantograph lab and, during the second part of the semester, propose, build, and present a significant final project that includes reconfigurable robot arms, imaging, forward and reverse kinematics.

204 Cory: EE128 students run experiments based on custom magnetic levitation apparatus and commercial inverted pendulla using Matlab, Simulink, and Quarc software.

Laboratory & Projects

Typical Courses: EE145L (Intro Electronic Transducer Lab)
EEC145M (Intro Microcomputer Interfacing Laboratory)
EE192 (Mechatronic Design Laboratory)

Facilities: 140 Cory: EE145L students do a large set of practical experiments with an emphasis on characterizing and interfacing a variety of sensors using op amps.

125 Cory: EEC145M students do labs about microprocessor interfacing techniques using Altera DE2-70 boards with custom A/D and D/A converters, and Qartus/NIOSII soft core processors.

204 Cory: EE192 students design an autonomous vehicle using tools such as Solidworks (mechanical design), Matlab (filter design), IAR (compiler, debugger), Eagle (PCB layout), and a choice of mechanical and hardware platforms for the microcontroller. This popular project lab course culminates in an end of term closed circuit race against the clock, both local and national in scope. Students also make use of a student machine shop, which also has SMT device and PCB design and milling capabilities.

EE design courses

Typical Courses: EEC125 (Introduction to Robotics)
EEC128 (Feedback Control)
EE130 (Integrated-Circuit Devices)
EE140 (Linear Integrated Circuits)
EE141 (Introduction to Digital Integrated Circuits)
EE143 (Microfabrication Technology)
EEC149 (Introduction to Embedded Systems)
EE192 (Mechatronic Design Laboratory)

Facilities: (see above)

EE applications

Typical Courses: EE145B (Image Processing and Reconstruction Tomography)
EE145L (Intro Electronic Transducer Lab)
EE145M (Intro Microcomputer Interfacing Laboratory)
EE117 (Electromagnetic Fields & Waves)

Facilities: (see above)

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CRITERION 7. FACILITIES

B. Computing Resources: Describe any computing resources (workstations, servers, storage, networks including
software) in addition to those described in the laboratories in Part A, which are used by the students in the
program.  Include a discussion of the accessibility of university-wide computing resources available to all
students via various locations such as student housing, library, student union, off-campus, etc.  State the
hours the various computing facilities are open to students.  Assess the adequacy of these facilities to support
the scholarly and professional activities of the students and faculty in the program.
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Computers: The EECS instructional support group provides about 20 logon servers for students in EE and CS courses, in addition to the 400 workstations in the instructional laboratories. Our computers run Windows, Linux, Solaris and MacOSX. All computers are networked and share home directories that are accessible from every EECS instructional computer, and via remote login. Each student can maintain a personal portfolio on our department WEB server. The labs also have accommodations for students' laptops. Using cardkeys, students have access the workstations in our labs 24 hours a day. The servers are also available 24 hours a day. At a given time, one third or more of the logged-in users are accessing our computers over the net from off-site locations. These resources are sufficient to serve the students in all EECS courses each semester.

In addition, the central campus computing support group provides general access computer labs that our students can also use at times during the day. The labs are listed in http://inst.eecs.berkeley.edu/share/b/pub/pdf/signs/Inst_facts.pdf and http://facility.berkeley.edu/facilities.html.

Single sign-on: The central campus computing support group provides an authentication service called CalNet that students and staff use to login to most on-line campus resources, including email, course registration, course WEB sites, libraries, human resources and many others.

Network Access: Most software that is required for assignments can be accessed remotely on our servers from anywhere on the Internet by students who have authorized login access. Students and staff can login via the campus wireless network (AirBears), which extends throughout the campus. The Residence Halls provide network access for students' computers, which allow them full access to our servers from the dorms. The libraries provide computers as well as network access for students' laptops. The central campus supports a VPN (virtual private network) that allows students to authenticate (using CalNet) from any computer and obtain access to campus services such as software licenses.

Adequacy: Those resources provide ubiquitous access to the facilities and computers that we provide for EECS coursework. The electronics lab activities are integrated with the computing infrastructure and supplement material covered in lectures.

Recent surveys of the students have indicated their general satisfaction with the facilities. However, the surveys also reaffirmed our observations that the wireless network was too slow in some locations and that the computers were too old and slow in some labs. To address those concerns, we have added wired network access (faster than wireless) for student laptops in several collaboration spaces, and we have started to upgrade several laboratories and servers. Instructional funding sustained a large cut at the start of our State budget crisis in 2009, and that prevented any equipment replacements for a couple of years. But we have regained some funding for it because of generous donations and because of austerity in other areas of the budget.

The EECS department funds 9 career staff specifically for technical support in the instructional engineering and computing facilities. The instructional staff is under a larger EECS IT group that provides network and disk storage services to the instructional computers. Additional EECS staff provides academic and administrative support to EECS students and faculty, including the upkeep of course WEB site content. This experienced staff works closely with faculty, research, and academic personnel to ensure ongoing review and planning for updating facilities, equipment, experiments, curricula, and student projects.

The central campus also has several senior technical groups dedicated to the support and improvement of the campus-wide on-line services. AirBears wireless capacity and continuity (the "wireless mesh") are being upgraded. A new partnership with AT&T will improve cell phone coverage in marginal areas. The campus course WEB portal (bSpace) is being upgraded (CalCentral).

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CRITERION 7. FACILITIES

C. Guidance: Describe how students in the program are provided appropriate guidance regarding the use of the
tools, equipment, computing resources, and laboratories.
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The technical support staff gives hands-on training to the TAs in the electronics lab. Many electronics lab are supported by a career staff who are present during lab usage. [Ferenc, do you want to add to this?]