Facilities and Laboratories

Most of the existing ECE laboratories are in the Facility Satellite one (FS1) building, and in the Raymond Ghosn Building (RGB). The FS1 is the temporary home for departmental labs. These labs will be moved to the Irani-Oxy Engineering Complex (IOEC) when it is completed.

Classrooms

The majority of the instruction takes place in the Bechtel Building, primarily in classrooms on the fourth and fifth floors of the building, and in the Jassim Al-Qatami Engineering Lecture Hall (ELH) on the third floor. All of the classrooms are provided with equipment for computer projection. Two medium conference rooms are available for project and seminar presentations.

Laboratories

Advanced Laboratories

The ECE department preserves several specialized teaching and research laboratories. These laboratories are used for research purposes as well as to enhance teaching through hands-on experience in the various fields of the department. In particular, lab courses, course projects, and final year projects make effective use of the facilities. Computer facilities are also available for student instruction and training.

Antenna Measurement Laboratory

This laboratory was established in the AY 2008-09 and is used to simulate, fabricate, and measure the properties of different types of antennas. It uses high end software to simulate the antennas and plot their characteristics. Once the researchers obtain the desired response, they will then be able to accurately prototype their design using a state of the art CNC milling machine. This machine is equipped with a 35 tool changer device and a fiducial camera that has the capability to produce designs with a milling accuracy of 1 µM. This accuracy has a large impact on the validity of the results. The last stage of the design process is to accurately measure the response achieved. Researchers using this lab benefit from a variety of high end measuring devices (spectrum analyzers, signal generators and network analyzers) with frequencies up to 20 GHz. In addition the department has acquired in 2012 a state of the art anechoic chamber capable of measuring attenuating frequencies up to 40GHz. In the coming academic year the department is expected to acquire a five axis rotating table to automate the measurement process. Students enrolled in Antenna Theory and Design (EECE 680), Advanced Antenna Design (EECE 681), Numerical Methods in Electromagnetics (EECE 683), and graduate students in the EMRF area utilize this lab.
**Biomedical Engineering Laboratory**

EEG measurements are conducted in this laboratory. The data collected is then utilized to understand the relationship between the voltage measured and the brain activity. The equipment in the laboratory is state of the art and utilizes the active probe technology. In AY 2010-11, the lab acquired additional equipment to add to the existing measuring system. This additional equipment allows researchers to measure electrical activity of muscles EMG. The laboratory also acquired a visual stimulus system to interface with EEG system. The laboratory is also used for instruction in the biomedical engineering courses (EECE 601, EECE 602, and EECE 605).

**Internetworking Lab**

The Internet Laboratory is equipped with computer and network hardware and software that can be used to build local-area and wide-area computer networks. The lab has six complete stations each equipped with four Dell Power Edge 650 servers, as well as four Cisco routers and four 3Com hubs. Students use this lab to develop their skills in networking, router and server configurations, and internet protocols. In 2011, the department acquired an elaborator simulation tool from OPNET which is an industry leader in network simulation. The laboratory equipment is scheduled for a major update during the AY 2013-2014. The lab is also used for conducting research in this field. Instruction in the Internetworking Laboratory (EECE 451L) uses the existing facilities.

**Mobile and Distributed Computing Laboratory / Reconfigurable computing**

This laboratory consists of ten high end work stations, two quad processor IBM servers, along with a high capacity blade servers powered by VMware. These computers are used to simulate databases and their applications. The lab is also equipped with state-of-art mobile devices used to conduct experiments on pervasive computing theories and distributed database architecture. In the year 2012 the laboratory expanded its research capabilities to include reconfigurable systems using FPGAs and SSDs. The laboratory is used for teaching the following related courses: Mobile Ad Hoc and Sensor Networks (EECE 656), Distributed and Object Database Systems (EECE 630), and Pervasive Computing Systems and Applications (EECE 654).

**Multi-Core Programming Laboratory**

This laboratory was established with the help of a generous donation from Intel and was inaugurated during the fall semester of AY 2008-09. This laboratory is used to teach students the techniques of writing software programs that takes full advantage of multi-core processor technology. The techniques taught allow students to run simulation software fast and efficiently. The hardware in the laboratory consists of two Intel 2U Server with Xeon Quad Core 2.33GHz, seven Intel PC with Xeon Quad core 2.66GHz, and eight Intel PC with Xeon Duo Core 2.66GHz mini-tower. In
addition to this primary roll the laboratory is also used to teach data mining techniques in data bases (Data Mining: EECE 633).

**Printed Circuit Board Production Facility**
This facility is equipped with all the tools necessary to produce single and double sided printed circuit boards using through-hole technology. It is primarily used for prototyping purposes. Students undergo training in this lab on all the processes and steps involved in the design and fabrication of the boards; at a later stage they can utilize this facility to produce their own designs. The laboratory houses a sophisticated CNC machine for rapid prototyping of circuit boards. The machine allows students to fabricate boards with an accuracy of 0.1µm. This capability allows researchers in the field of RF circuits and antenna design to prototype circuits with perfect quality. The machine is also capable of producing circuit boards on flexible material or on multi layer boards.

**RF Systems and Wireless Communications Laboratory**
The RF lab is equipped with the several network analyzers, spectrum analyzers, RF signal generators, and power meters. It is utilized by students to design, build, and test: RF filters, power amplifiers, and antennas. The laboratory uses several design and verification software tools to simulate the design before actual implementation. The laboratory is used to teach the latest technologies in wireless communication. Students design networks using industrial grade network planning tools and then use drive test equipment to validate and test cellular networks. This facility is also used for research in radio frequency circuits and systems, and in wireless communications. Instruction for two courses is offered in this laboratory: RF and Microwave Circuits for Communications (EECE 613), and Wireless Communications Laboratory (EECE 640L).

**Robotics and Instrumentation Laboratory**
In this laboratory, students learn the fundamentals of instrumentation and robotics. New sensors both wired and wireless have been acquired for the laboratory. In the robotics lab, five mobile robots with full wireless control have been added to the two already existing manipulators. In 2011, the family of robots was expanded to include there humanoids, a quad rotor Arial robot and a six meter long autonomous blimp. Several courses and research projects in instrumentation and tele-robotics are taught in this lab. This lab is also used for research in advanced control algorithms, robotics, and instrumentation. The laboratory is used for instruction in the Control Systems (460L), Instrumentation (EECE 461), Industrial Automation (EECE462L), and the Robotics (EECE 661) courses.

**Signal and Image Processing Laboratory**
In this laboratory, students carry out experiments in digital signal, image, and speech processing. Equipment includes DSP kits provided by Texas Instruments, audio synthesizers, computers and multimedia accessories. The laboratory was recently equipped with state of the art audio equipment that allowed the offering of an elective
course in audio engineering. During AY 2009-10, new equipment was purchased to upgrade this laboratory. This new requisition will enable the department to offer specialized laboratory courses at the graduate level as well as the standard undergraduate offerings. In 2011, the laboratory acquired several high end VGA boards that enabled the teaching of GPU programming using CUD. In that same year, the laboratory was named CUDA teaching center. Courses using this laboratory include Digital Signal Processing (EECE 691), Digital Image Processing (EECE 694), Adaptive Filtering (EECE 695), as well as the Final Year Projects. To service and host EECE503 (Audio Engineering) labs and course projects in 2005, the laboratory was equipped with five 24-bit/196kHz, 4IN/4OUT AVID audio converters and mic preamps, in addition to PCs running ProTools®, the industry standard for digital audio recording, processing, and post-production. FYPs and graduate researches also benefit from the modestly (but quality) equipped digital audio workstations (DAW) running a variety of audio DSP plug-ins. The latest acquisition and addition of matched-pair stereo condenser microphones to the already existing state of the art audio equipment offer students tools to record/edit/mix/master 64-track audio in pristine digital quality, to learn and implement soundtrack design techniques for films, stereophonic sound production techniques, room acoustical impulse responses and artificial reverberation.

Industrial Networks and Automation Laboratory
The lab is designed to introduce the students to the different industrial network protocols that are used to link distributed controllers, sensors and human machine interfaces to each other. The laboratory is equipped with network hardware and simulators for more than six different types of industrial protocols. In 2011, the laboratory installed six state of the art industrial automation stations consisting of networked PLCs and touch screens with a number of input and output devices. The equipment for this laboratory has been commissioned and laboratory experiments are being developed. The equipment for this laboratory has been commissioned, Laboratory experiments were developed and the lab entitled Industrial Automation EECE 462L was first offered during the spring term 2011. The current experiments are being updated to include the newly acquired industrial peripherals. The updated lab can be implemented by fall term of 2013.

Network Security
This laboratory was established in AY 2008-09 and houses an independent fully functional network that consists of 10 user nodes along with 4 servers running different applications and operating systems. The laboratory has a number of layer 2, and layer 3 switches hardware firewalls, routers, and wireless access points. This infrastructure allows students to experiment with the different layers of the physical network, learn about their vulnerabilities, and develop techniques to protect the
network. In 2010, the laboratory acquired a network traffic generator as well as packet shapers that enabled testing of real scenarios.

**VLSI Design and Simulation**
This laboratory was established during the AY 2010-11. The laboratory is equipped with a cluster of servers as well as 10 workstations. The server cluster is running a range of state of the art design and simulation tools. These tools include most of the packages from Cadence, Mentor Graphics, and Synopsys. The laboratory is capable of fabricating successful designs at affiliated foundries.

**Computer Laboratories**
Computer laboratories shared by the various departments in the FEA are available to ECE students for instruction and project execution. Several computer labs are available in the SRB and in the RGB and house more than 200 PCs, Apple computers, and Sun workstations. Scanners, plotters, and laser printers are also available. Additionally, working space and computer stations are available to ECE students in the various laboratory and department facilities, described above.

Students can connect to the AUB data network (AUBnet) using the networked computers available in laboratories, or use their personal laptops or PDAs (Personal Digital Assistant) to connect to the campus-wide wireless network, AUBwlan. More information is available on the FEA IT Unit website (http://webfea.fea.aub.edu.lb/fea/itunit/), and on the website of the Computing and Networking Services Department. (http://www.aub.edu.lb/cns/).