ECE GRADUATE
STUDENT MANUAL
2011–2012
Notice

Information in this manual applies to academic year 2011-12. It is subject to change without notice. Students are responsible for checking their AUB e-mail (http://imail.aub.edu.lb) and post-office boxes for announcements and information.

The information in this manual and any updates to it can be viewed on the website of the Department of Electrical and Computer Engineering at http://www.aub.edu.lb/ece/
Course syllabi, thesis guidelines, student training, and many other useful documents and forms are also available through the website.

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FEA Quadrant Map
Useful Phone numbers

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Foreword

Welcome to the Department of Electrical and Computer Engineering (ECE) at the American University of Beirut (AUB). We look forward to having you become a resourceful member of the department and we wish you success on your academic journey.

This manual is intended to assist you in understanding the requirements, policies, and procedures required to successfully complete your degree. The rules and regulations provided in this manual oversee our master’s and PhD programs and describe the duties and responsibilities of graduate students in the department.

These rules and regulation have developed over the years and have proven to be beneficial. This manual and will offer you useful information and resources to ease and enhance your experience in the department. Each student is expected to be familiar with the information presented and to stay in touch with the department in case there are changes.

We are always interested in hearing your suggestions and comments about our programs and courses, and about your experiences as a student in the ECE department. Please send your questions and feedback in writing to the Graduate Studies Committee of the department via: ece-advice@aub.edu.lb

Our best wishes for a productive and successful 2011-12 academic year.

From the ECE Chairperson,

Karim Kabalan
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1. The University

1.1 American University of Beirut

The American University of Beirut (AUB) is a private, independent, nonsectarian institution of higher learning, founded in 1866. It functions under a charter from the State of New York and is governed by a private, autonomous Board of Trustees. Degrees awarded by the American University of Beirut are officially registered with the Ministry of Higher Education in Lebanon and with the Board of Education in the State of New York. AUB was granted institutional accreditation in June 2004 by the Commission on Higher Education of the Middle States Association of Colleges and Schools, 3624 Market Street, Philadelphia, PA 19104, 215-662-5606.

1.1.1 Mission Statement

The American University of Beirut (AUB) is an institution of higher learning founded to provide excellence in education, to participate in the advancement of knowledge through research, and to serve the peoples of the Middle East and beyond. Chartered in New York State in 1863, the university bases its educational philosophy, standards, and practices on the American liberal arts model of higher education. The university believes deeply in and encourages freedom of thought and expression and seeks to foster tolerance and respect for diversity and dialogue. Graduates will be individuals committed to creative and critical thinking, life-long learning, personal integrity and civic responsibility, and leadership.

1.2 Faculty of Engineering and Architecture

1.2.1 Mission Statement

The Faculty of Engineering and Architecture (FEA) at the American University of Beirut is a leading professional school in the Middle East. The FEA offers educational programs of the highest standards, promotes research and creative scholarly activities of its faculty and students, and provides services to the community at large, while addressing the needs of Lebanon and the region. The FEA undergoes continuous improvement to maintain a challenging and intellectually stimulating environment, and prepares its students to be lifelong learners, innovators, and professionals capable of being leaders in their chosen careers, committed to personal integrity and civic responsibility.
2. Department of Electrical and Computer Engineering (ECE)

2.1 Introduction

As early as 1913, the university recognized the need for engineering education and training in the Arab East, and courses in this field were offered in the School of Arts and Sciences. In 1951, a separate School of Engineering was established and curricula were initiated in Architectural Engineering, Civil Engineering, Electrical Engineering, and Mechanical Engineering. In 1966, the School was renamed the Faculty of Engineering and Architecture (FEA) that comprised, among others, the Department of Electrical Engineering, which was later renamed the Department of Electrical and Computer Engineering (ECE).

The mission of the Department of Electrical and Computer Engineering is to prepare its students in a challenging environment for leading roles in their major fields of study. It also prepares them for life-long learning, and fosters critical and independent thinking, innovation, ethical conduct, and effective communication. The department promotes excellence in education and research, and provides services to the community at large.

On the graduate level the Department of Electrical and Computer Engineering offers the degree of Master of Engineering (ME) in Electrical and Computer Engineering, with the following options:

- ME in ECE: Thesis Program
- ME in ECE: Non-Thesis Program
- ME in ECE: ICT Program

The ECE department also offers the degree of Doctor of Philosophy (PhD) in Electrical and Computer Engineering.

Research in the department is performed by faculty members and students in diverse areas such as applied electromagnetics and RF systems, biomedical engineering, communications, computer architecture and VLSI circuits, control and intelligent systems, energy and power systems, networks, signal and image processing, and software systems.
2.2 **Full-Time Faculty members**

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</table>
2.3 ECE Support Staff

A total of 6 staff members are currently available to support the ECE department (Table 2.)

Mr. Joujou, the lab manager, oversees the proper functioning of all laboratories for the ECE department. He also directs the preparation of labs for educational sessions as advised by faculty members.

<table>
<thead>
<tr>
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<th>Title</th>
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2.4 Facilities and Laboratories

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

2.4.1 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 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.
2.4.2 Advanced Laboratories

The ECE department maintains several specialized teaching and research laboratories. The 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. To do so they will use a recently acquired 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. Antenna Theory and Design (EECE 680), and Numerical Methods in Electromagnetics (EECE 683) use this lab. In AY 2009-10 the laboratory acquired, an anechoic chamber to more accurately validates the measurements.

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 is used for instruction in the biomedical engineering courses (EECE 601, EECE 602, and EECE 605).

Internetworking Lab

The Internet Laboratory is equipped with state of the art 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. The lab is also used for conducting
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research in this field. Instruction in the Internetworking Laboratory (EECE 451L) takes place in this Lab.

**Mobile and Distributed Computing Laboratory**
This laboratory consists of ten high end work stations along with two quad processor IBM servers. These computers are used to simulate databases and their applications. The lab is also equipped with more than 24 PDAs. They are used to conduct experiments on pervasive computing theories and distributed database architecture. 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. The laboratory can accommodate up to twenty students at a time. The laboratory is used to teach the 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 role 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. 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 Instrumentation (EECE 461), 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 for the laboratory. This new requisition will enable the department to offer specialized laboratory courses at the graduate level as well as the standard undergraduate offerings. 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.

**Sun Cluster**

It consists of ten Sun-Blade 150 machines and ten Sun-Blade 1500 machines. In addition to these workstations, the cluster is managed by a quad-processor Sun-Fire 440 server. The Sun computational grid is accessible from any terminal and runs a number of simulation software.

**Industrial Networks 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. The equipment for this laboratory has been commissioned and laboratory experiments are being developed.

**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.

**Laboratories under Development**

**VLSI Design and Simulation**

This laboratory will be established during the academic year 2010-11. The laboratory will be equipped with a cluster of servers as well as 10 workstations. The server cluster will be 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 will be able to fabricate successful designs at affiliated foundries.

**Cooperative Robotics**

This laboratory will be established during the academic year 2010-11. The laboratory will have a number of robots. These robots will include two humanoids and aerial robot and a submersible. Research on collaborative and tele-robotics will be conducted using the robots.

**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.

**2.5 Internet Access for Graduate Students**

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/).

2.6 Offices for Graduate Students

The ECE department attempts to provide office space for all full-time graduate students. All graduate assistants and graduate research assistants will be provided with a desk and access to a computer, but other graduate students may be asked to share desk space. The offices are primarily for studying and holding office hours, either individually or in groups. Please try to respect the needs of other students for quiet in the same or adjacent offices.

A key will be issued to each occupant assigned to an office. The secretary of the department assists graduate students in obtaining office keys. Students have 24 hour access to work on campus however it is not permitted to spend the night in an office. The campus security routinely checks the buildings.

Smoking policy:

1. Smoking: Is not permitted anywhere on the university’s property, except for private faculty residences and designated locations. Smoking is prohibited in all university buildings and outdoor areas including public spaces and roadways, the Green Field, spectator seating, outdoor dining areas, covered walkways, AUB gates, entrances, and parking areas. Smoking is also prohibited in university vehicles at all times, and in other private vehicles while they are on campus.

2. Designated Smoking Areas: Smoking is only permitted in university designated areas which extend over a radius of 5 meters from the signs designating a smoking area. The dean of student affairs will, at his/her discretion, designate those floors in selected student residences where smoking is permitted.

3. Sales/Advertisements: The sale, distribution, or advertisement of tobacco products is prohibited in university facilities and public areas. Financial contributions from tobacco companies to AUB activities such as sports and cultural events are also prohibited.

Compliance and Implementation
1. All persons on AUB property are required to abide by this policy. This policy is to be implemented by units and departments in the same manner as other university policies. Breaches of the policy should be reported to the Environmental Health and Safety Center, extension 2360.

2. Campus Protection personnel are authorized to monitor compliance with the policy among visitors, students, staff, and faculty. Protection personnel will request anyone in violation of the policy to comply immediately, failing which protection personnel may ask the offenders to supply their names and ID numbers. Protection personnel will then report the offenders to the dean of student affairs, the staff member's supervisor, the faculty member's dean, or the provost.

3. Persons who are found to have breached the policy will be subject to disciplinary action in accordance with the Student Code of Conduct. [http://pnp.aub.edu.lb/general/conductcode/](http://pnp.aub.edu.lb/general/conductcode/).
Graduate Programs

The Department of Electrical and Computer Engineering offers the degree of Doctor of Philosophy (PhD) in Electrical and Computer Engineering, and the degree of Master of Engineering (ME) in Electrical and Computer Engineering.

2.7 Master in Electrical and Computer Engineering

The department offers the following graduate programs, all leading to the Master of Engineering in Electrical and Computer Engineering (ME in ECE) degree:

- ECE Thesis Program
- ECE Non-thesis Program
- Information and Communications Technology Program (ICT).

All programs must satisfy either the thesis program requirements or the non-thesis program requirements. The program is indicated on the student’s transcript.

2.7.1 Application for Admission

Application forms for admission to graduate study in the Department of Electrical and Computer Engineering may be obtained from the Office of Admissions. All applications for admission should be made on these forms and returned to the Office of Admissions. Any subsequent correspondence prior to registration should also be addressed to the Office of Admissions. Completed application forms should reach the Office of Admissions by February 20 for applicants who wish to begin graduate study in fall and by November 30 for applicants applying for spring. For any updates concerning the deadline, please refer to the admissions website: http://www.aub.edu.lb/admissions/Pages/index_old.aspx

Applicants must:

- Choose the graduate program(s) they are applying to: ME in ECE with Thesis Option, ME in ECE with Non-Thesis Option, ME in ECE with ICT Option.
- Provide at least two letters of recommendation from professors or supervisors.
- Provide an official transcript covering at least the end of the first semester of the senior year or its equivalent.
- Take the GRE General Test and have scores sent to AUB.
• A written statement of purpose indicating their undergraduate preparation, their skills, and their general research interests.

Applications may include an application for graduate assistantships, if desired.

The criteria for admission are based on the following:
• A bachelor’s degree from an accredited university. Students whose undergraduate degrees are in areas other than electrical and computer engineering, and students whose undergraduate degrees are three-year degrees, may be considered only as prospective graduate students.
• Student’s performance during the last two years of undergraduate studies. A minimum average of 80/100 at AUB or its equivalent GPA is the minimum required, but does not guarantee acceptance.
• GRE General Test scores
• Satisfying all relevant admission requirements of the Faculty of Engineering and Architecture (FEA) and AUB.
• Once accepted and before joining a thesis program, the student is required to write a research statement indicating his/her research experience and research interests.

The ECE Graduate Committee (EGC) may request an interview with students applying to the thesis program.

2.7.2 Admission on Probation

An applicant may be admitted on probation if s/he has an average for the last two years of 75/100 at AUB or its equivalent at other universities as determined by the department. A student admitted on probation has to complete nine credits of graduate-level courses during the first two semesters of graduate studies, has to pass all courses, and has to attain a minimum cumulative average of 80/100 to become a regular graduate student. If the student fails to meet any of these conditions, s/he will be dropped from the graduate program.

2.7.3 Admission as a Prospective Graduate Student

This category is reserved for students applying to graduate study in a field other than that of their undergraduate major or students whose undergraduate degrees are three-year degrees. The department will recommend to the FEA Graduate Studies Committee the supplementary undergraduate courses the applicant must take before consideration for admission to graduate work. Upon the applicant’s completion of the supplementary undergraduate courses with a cumulative average of at least 80/100, the department may recommend admission to the graduate program.
The supplementary courses must be completed within four consecutive semesters, excluding summers.

2.7.4 **English Language Proficiency Requirement (ELPR)**

Applicants to the graduate program, other than AUB graduates and graduates of recognized colleges or universities in North America, Great Britain, Australia, and New Zealand, must meet the English Language Proficiency Requirement (ELPR).

A score of 550 on the English Entrance Examination (EEE), or 600 on the paper-based Test of English as a Foreign Language (TOEFL), or 250 on the computer-based TOEFL, or 97 on the Internet-based TOEFL, is required for admission of new applicants to graduate study, or prospective graduate study, from recognized institutions of higher education. Applicants with scores on the English Proficiency Tests as indicated below should take the following English courses.

<table>
<thead>
<tr>
<th>Course</th>
<th>EEE</th>
<th>TOEFL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Paper-Based</td>
</tr>
<tr>
<td>ENGL 300</td>
<td>500-549</td>
<td>573-599</td>
</tr>
</tbody>
</table>

Graduates placed in ENGL 300 will be allowed to take one graduate course during the first semester of their enrollment. Applicants must obtain a minimum grade of 70 in ENGL 300 otherwise they will be dropped from the graduate program.

Graduate applicants who score 500 or better on the verbal reasoning section of the general part of the Graduate Record Examination (GRE) are exempted from taking any English proficiency test for the purpose of meeting the ELPR.
2.7.5 Courses and Grades

Courses taken as part of the student graduate program fall in one of two categories: graduate level course or prerequisite courses.

Graduate Level Courses

These are normally numbered 600 or above. The minimum passing grade for a graduate course is 70. Students in the graduate programs are required to maintain a cumulative average of at least 80 in courses taken for graduate credit. A student who is absent without excuse from more than one third of the number of sessions in any one course, or who fails to sit for scheduled examinations, or fails to fulfill required written or oral work, will be given the minimum grade for graduate courses, which is 55.

The grades of the tutorial courses, projects, or theses are reported as Pass (P) or Fail (F).

Prerequisite Courses

Graduate students in thesis programs may take one 3-credit undergraduate course to complete the 24-credit course requirement, subject to approval by their adviser and the Graduate Committee of the department (EGC). Students who choose to, or are required to, take undergraduate courses (normally numbered between 400 and 498) must obtain a grade of at least 70 in each undergraduate course taken. If a student fails to obtain a grade of 70 in any undergraduate course, the student is allowed to repeat that course only once. Failure to meet the requirements stipulated above will result in the student’s dismissal from the graduate program.

Notes Regarding Courses

- The same course cannot be used to satisfy the requirements of the major and the minor areas (refer to page 19).
- Special topics and special projects cannot be core courses. They may be counted as electives after approval of the respective area committee.
- The credit requirements of the major or minor areas may be satisfied by courses taken prior to joining the graduate program.

In all cases, students need to satisfy the total number of credits required for the degree.
2.7.6 Transfer of Credits

Graduate courses taken beyond the requirements for the bachelor’s degree at AUB or at other recognized institutions are not transferable for credit toward the requirements for the master’s degree, unless these credits are taken as an overload and not counted toward the degree requirement and the applicant attains a cumulative average of at least 80 or equivalent in the undergraduate courses taken in the major field of study. Only courses in which the applicant has earned a grade of 80 or above may be transferred.

Graduate courses taken beyond the courses required for a master’s degree at AUB or at other recognized institutions, and in which the applicant earns a grade of 80 or above, may be transferred to another master’s degree at AUB.

Not more than nine credits are transferable.

Approval of the ECE Graduate Committee and the FEA Graduate Studies Committee is required for all transfers of credits.

2.7.7 Academic Evaluation

**Students Admitted on Probation**

- A student admitted on probation has to complete nine credits of graduate level courses during the first two semesters of graduate studies.
- Has to pass all courses, and has to attain a minimum cumulative average of 80 to become a regular student.

If the student fails to meet any of these conditions, s/he will be dropped from the graduate program.

**Students placed on probation during regular status residency**

- A student is placed on probation if s/he attains a cumulative average of 70 or more, but less than 80.
- A student is placed on probation if s/he fails any course taken for graduate credits. (This rule does apply to the first term of study).

Student placed on probation due to course failure must retake the course the next time it is offered and pass the course. In case where this condition cannot be met, the student in consultation with the adviser must petition the FEA Graduate Studies Committee.

This probation must be removed at the end of the following term by attaining a cumulative average of at least 80.
Dismissal

• A student is dropped from the graduate program, if s/he fails to remove the probation.
• A student is dropped from the graduate program, if s/he receives probation for a second time during the degree residency.
• A student is dropped from the graduate program if s/he attains a cumulative average of 70 or more, but less than 80, in any term and fails one course in that term. (This rule does not apply to the first term of study.)
• A student is dropped from the graduate program if s/he attains a cumulative average of less than 70 or fails two courses in one term.
• A student is dropped from the graduate program if the work of the student is considered to be unsatisfactory in the opinion of the department or program, and regardless of the grades obtained.
• A student is dropped from the graduate program if s/he fails the comprehensive examination twice or the thesis defense twice.
• A student is dropped from the graduate program if s/he accumulates two consecutive failures in the seminar course.

A student dropped from a graduate program will not be allowed to re-enroll in the same program at any future date.

2.7.8 Advising

All accepted graduate students are assigned a pre-adviser by the ECE Graduate Committee, based on their research interests as stated in their research statement, or for non-thesis students based on their application. The pre-adviser informs students about graduate studies in the department, helps students in identifying courses to take, and orients students planning for a thesis to identify potential research areas and relevant faculty members to consult.

By the end of their first semester, students planning for a thesis should declare a major area.

During their second semester, students planning for a thesis should choose a thesis adviser.

2.7.9 ECE Thesis Program Requirements

Thirty (30) credit hours: 24 course credit hours and 6 thesis credit hours

• A minimum of 21 credits in graduate courses
• A minimum of 18 credits in ECE courses
• A minimum of 9 graduate credits in the major area (6 core and 3 elective credits)
• A minimum of 6 graduate credits in the minor area (3 core and 3 elective credits)
• 6 credits for master’s thesis
• Seminar course

2.7.10 ECE Non-Thesis Program Requirements

Thirty-three (33) credit hours in graduate courses

• A minimum of 12 graduate credits in the major area (6 core credits)
• A minimum of 6 graduate credits in the minor area (3 core credits)
• A minimum of 24 credits in EECE courses
• Seminar course

2.7.11 Information and Communications Technology Program (ICT)

The Information and Communications Technology Program (ICT) is consistent with the requirements for the ME in ECE thesis program, and consists of 30 credits distributed as follows:

• 15 credits in core courses
• 9 credits in elective courses
• An internship (no credit) with a minimum duration of 10 weeks and a maximum duration of 6 months (EECE 700).
• 6 credits for master’s thesis
• Seminar course

The courses are divided into three areas: software systems, telecommunications, and business/management. The 15-credit core courses should satisfy the following conditions:

• 6 credits in software systems selected from a set of core courses
• 6 credits in telecommunications selected from a set of core courses
• 3 credits in business/management selected from a set of core courses

The 9-credits in elective courses must satisfy the following conditions:
• one regular 3-credit course from either the software systems elective pool or the telecommunications elective pool
• one regular 3-credit course from the business/management elective pool
• the remaining 3 credits consist of one graduate level lab course and two technical special courses
all elective courses must be taken from the three defined pools of elective courses (software systems pool, telecommunications pool, and business/management pool).

2.7.12 ICT Core Courses

- Software Systems: EECE 625, EECE 630, EECE 635, EECE 654,
- Telecommunications: EECE 640, EECE 643, EECE 651, EECE 653, and EECE 655
- Business/Management: DCSN 330, INFO 300, and INFO 310

2.7.13 ICT Elective Courses

- Software Systems: EECE 625, EECE 630, EECE 631, EECE 632, EECE 634, EECE 635, EECE 652, and EECE 654
- Business/Management: DCSN 330, INFO 300, INFO 310, INFO 315, INFO 320, MKTG 306, ENMG 654, ENMG 656, and ENMG 657
- Lab courses: EECE 640L, EECE 651L, EECE 655L and EECE 691L

2.7.14 Master’s Degree - Major and Minor Areas

The major and minor areas for the ME and PhD programs are shown below, with their corresponding courses.

Applied Electromagnetics and RF Systems Area

Core Graduate Courses
EECE 613: RF and Microwave Circuits for Communications
EECE 680: Antenna Theory and Design
EECE 682: Time-Harmonic Electromagnetic Field

Elective Graduate Courses
EECE 643: RF System Engineering for Wireless Communications
EECE 681: Advanced Antenna Design
EECE 683: Numerical Analysis in Electromagnetics

Biomedical Engineering Area

Core Graduate Courses
EECE 601: Biomedical Engineering I
EECE 602: Biomedical Engineering II
EECE 603: Biomedical Signal and Image Processing

Elective Graduate Courses
EECE 605: Neuroengineering I
EECE 661: Robotics
EECE 667: Pattern Recognition
EECE 693: Neural Networks
EECE 694: Digital Image Processing

Communications Area

Core Graduate Courses
EECE 640: Wireless Communications
EECE 641: Information Theory
EECE 646: Advanced Digital and Data Communications

Elective Graduate Courses
EECE 604: Communications Engineering for Genetics and Bioinformatics
EECE 642: Introduction to Coding Theory
EECE 643: RF Systems Engineering for Wireless Communications
EECE 644: Stochastic Processes, Detection and Estimation
EECE 645: The UMTS Cellular System
EECE 691: Digital Signal Processing
EECE 694: Digital Image Processing
EECE 695: Adaptive Filtering

Computer Architecture and VLSI Circuits Area

Core Graduate Courses
EECE 611: Introduction to Analog VLSI Systems
EECE 612: Digital Integrated Circuits
EECE 616: Advanced Digital Integrated Circuits
EECE 621: Advanced Computer Architecture
EECE 623: Reconfigurable Computing

Elective Graduate Courses
EECE 613: RF and Microwave Circuits for Communications
EECE 614: Computer Aided Analysis and Design of VLSI Circuits and Systems
EECE 615: Computer Methods for Circuit and System Simulation
EECE 622: VLSI for Communications and Signal Processing
EECE 624: Digital Systems Testing
EECE 625: Embedded Systems Design
Control Systems Area
Core Graduate Courses
EECE 660: System Analysis and Design
EECE 661: Robotics
EECE 663: System Identification

Elective Graduate Courses
EECE 662: Optimal Control
EECE 665: Adaptive Control
EECE 667: Pattern Recognition
EECE 664: Fuzzy Sets, Logic, and Applications.
EECE 693: Neural Networks

Energy and Power Systems Area
Core Graduate Courses
EECE 670: Power System Planning
EECE 675: Renewable Energy Systems
EECE 678: Advanced Power Systems Analysis

Elective Graduate Courses
EECE 671: Environmental Aspects of Energy Systems
EECE 672: Energy Policy and Planning
EECE 673: Power Electronics Systems and Applications
EECE 677: Electric Power System Control and Stability
EECE 798A: Special Topics in High Voltage Transmission Systems
EECE 798B: Special Topics in Generation Operation and Control

Machine Intelligence Area
Core Graduate Courses
EECE 633: Data Mining
EECE 664: Fuzzy Sets, Logic, and Applications
EECE 667: Pattern Recognition
EECE 693: Neural Networks

Elective Graduate Courses
EECE 631: Advanced Topics in Algorithms
EECE 639: Advanced Data Mining
EECE 661: Robotics
EECE 662: Optimal Control
EECE 663: System Identification
EECE 665: Adaptive Control
EECE 668:  Game Theory and Decision Making
EECE 694:  Digital Image Processing
EECE 695:  Adaptive Filtering

Networks and Security Area

Core Graduate Courses
EECE 632:  Cryptography and Computer Security
EECE 651:  Internet Engineering
EECE 653:  Multimedia and Networking
EECE 655:  Internet Security
EECE 656:  Mobile Ad hoc and Sensor Networks
EECE 657:  Wireless Network Security

Elective Graduate Courses
EECE 630:  Distributed and Object Databases
EECE 640:  Wireless Communications
EECE 647:  Queuing Theory
EECE 652:  Web Server Design and Programming
EECE 654:  Pervasive Computing

Signal and Image Processing Area

Core Graduate Courses
EECE 603:  Biomedical Signal and Image Processing
EECE 691:  Digital Signal Processing
EECE 694:  Digital Image Processing
EECE 695:  Adaptive Filtering

Elective Graduate Courses
EECE 644:  Stochastic Process, Detection and Estimation
EECE 663:  System Identification
EECE 667:  Pattern Recognition
EECE 693:  Neural Networks
EECE 696:  Applied Parallel Programming

Software Engineering Area

Core Graduate Courses
EECE 631:  Advanced Topics in Algorithms
EECE 636:  Analysis and Verification of Software
EECE 637:  Advanced Programming Practice
EECE 638:  Software Testing
Elective Graduate Courses
EECE 630: Distributed and Object Database Systems
EECE 632: Cryptography and Computer Security
EECE 652: Web Server Design and Programming
EECE 654: Pervasive Computing Systems and Applications
EECE 696: Applied Parallel Programming
EECE 732: Pseudo Randomness

2.7.15 Thesis proposal

When following a graduate program leading to the master’s degree with the thesis option, the student is expected to meet with faculty members in the department to discuss with them possible thesis topics and arrange to have a thesis adviser. Normally, the thesis adviser is from among the full-time professorial faculty of the department.

The student is expected to select a research topic in consultation with the thesis adviser and prepare a thesis proposal by the end of the second regular semester. The proposal must clearly state the problem to be addressed and the proposed contributions.

The thesis proposal should state the thesis objectives, scope of work with relevant literature, research methodology, and expected results and must indicate if the proposed research involves human subject research or animal related research; and if so seek approval/confirmation or exemption of the Institutional Review Board and/or the Animal Care Committee.

The student must select a thesis committee consisting of at least three members from the professorial rank, chaired by the thesis adviser and including at least two other faculty members. The thesis committee is formed by the thesis adviser and the student in coordination with the chairperson of the department.

The student must submit the thesis proposal to the committee and receive their approval. The committee members shall evaluate the proposal through a review with the thesis adviser.

The student must submit the thesis proposal with a completed thesis proposal form to the chairperson of the department, signed by the thesis adviser and all members of the thesis committee, with the expected date of the comprehensive examination, expected date of thesis defense, and courses taken so far.
In cases where the thesis adviser is from another department, the chairperson will consult with the chairperson of the department to which the thesis adviser belongs. At least two members of the thesis committee must be members of the ECE department. The remaining member(s) can be from ECE, FEA, AUB, or from an institution other than AUB.

Once approved, the chairperson forwards the thesis proposal with the names of the thesis committee members to the Graduate Studies Committee for approval.

The Graduate Studies Committee will inform the chairperson of the proposal approval, and the chairperson will communicate the approval to the thesis adviser.

2.7.16 Comprehensive Examination

This exam must be taken by the end of the third regular semester and after completing at least two courses in the major area and one course in the minor area.

Students must be registered for the comprehensive exam (EECE 799T) in the term in which they will take this exam.

The thesis committee shall serve as the comprehensive examination committee.

The comprehensive examination consists of a presentation of the research proposal, questions related to the student’s graduate courses, and background questions related to the major and minor areas.

A student who does not pass the comprehensive examination may take it a second time (EECE 799T) after a period of at least three months. The old failing grade will be deleted and replaced by the new passing grade indicating on her/his transcript.

It is the student’s responsibility to keep members of the thesis committee updated about the status of the proposed research and seek their input.

2.7.17 Thesis Defense Requirements and Deadlines

The student can take the thesis defense at least six months after approval of the thesis proposal.

The deadlines for the thesis defense for students who wish to graduate in summer, fall, or spring are October 30, March 1, and June 10, respectively.
Students must be registered for the thesis (EECE 799) in the term in which they expect to graduate in order to present their defense.

A final draft of the thesis must not be prepared by the student before it is discussed with each member of the thesis committee. The final draft of the thesis must be submitted to each member of the thesis committee at least two weeks before the date of the thesis defense.

The thesis defense will be open to the public and shall be announced at least two weeks in advance. The total time allocated for the defense should allow for answering all questions and will normally not exceed 90 minutes.

The thesis defense session is normally chaired by the thesis adviser and shall be conducted according to the following procedure:

- Introduction of the student defending the thesis by the thesis adviser.
- Presentation of the work by the student in 35 to 40 minutes.
- Questions first from members of the public, then the thesis committee, starting with general and clarification questions, followed by more specific, technical questions.
- At the end of the thesis defense, the student and the public shall be requested to leave the room to allow the thesis committee to deliberate and reach a decision concerning the evaluation of the thesis.

“Pass” or “Fail” is reported for the combined thesis and thesis defense. If “Fail” is reported, the student may resubmit the thesis and defend it after a period of at least three months. Failure on the second attempt results in discontinuation from graduate work.

When a student registers for the thesis the first time, the thesis tuition is equivalent to seven graduate credits of tuition and is valid for a maximum of four thesis registration sessions. The three thesis registration sessions following the first registration session are for zero credits of tuition. For any subsequent thesis registration after the first four registration sessions, a thesis fee equivalent to three graduate credits will be applied.

The results of the comprehensive examination and thesis defense shall be reported on a special form (available in the department), signed by the chairperson and members of the thesis committee. This form shall be sent by the chairperson to the Registrar with a list of the graduate courses completed by the student, and the grades obtained in these courses.
The chairperson shall write to the dean recommending that the student be granted the master’s degree.

The student, after passing the thesis defense, must deposit one copy of the thesis, complete with abstract and signatures of the members of the thesis committee, at the Jafet Memorial Library. The receipt of this copy must be submitted by the student to the Office of the Registrar before the student is awarded the degree. The student should sign a release form indicating whether or not the library is authorized to supply copies of the thesis to other libraries or individuals. The non-authorization option is valid for a period of two years only, after which copies of the thesis will be supplied on request.

The deadlines for submitting the copy of the thesis to the library for students who wish to graduate in summer, fall, or spring are November 10, March 10, and June 20, respectively.

The Thesis Manual, which provides instructions on the preparation of the thesis, is available at the Jafet Memorial Library.

2.7.18 Comprehensive Examination for Students in Non-Thesis Programs

A student in the non-thesis graduate program must take the comprehensive examination after enrolling in all major and minor area courses, and not later than the second week of the term in which the student is expected to graduate.

Students must be registered for the comprehensive exam (EECE 799T) in the term in which they will take this exam.

A supervisory committee composed of three faculty members (two faculty members in the major area and one faculty member in the minor area) is selected by the chairperson in consultation with the graduate student.

The supervisory committee conducts the comprehensive examination. The examination is an oral examination that consists of questions related to the student’s graduate courses in addition to background questions related to the major and minor areas.

2.7.19 Residency Requirement

To meet the minimum residence requirements for the master’s degree, a student must register and be in residence as a graduate student for at least two semesters, one semester and two summers, or four summers. All requirements for the master’s degree must be completed within a period of four years after admission to graduate study. Students attending only summer
sessions must complete all requirements within a period of six summers after admission to graduate study. Extension beyond the maximum allowed period of study requires the approval of the ECE Graduate Committee and the FEA Graduate Studies Committee.

2.7.20 Seminar Requirement

Enrolled students should register in the seminar course EECE 797 at least twice and attend at least 70% of the lectures every time they register. A graduate student is expected to give a seminar and to attend theses defenses in the department while enrolled in the graduate program.
3. Assistantships

3.1 Graduate Assistantships and Graduate Research Assistantships

3.1.1 Graduate Assistant (GA)

Graduate assistants will have the cost of tuition waived for those courses registered toward the graduate degree and a paid stipend commensurate with the assigned instructional work load. The ensuing costs of the preceding stipends are covered from the instructional funds of the faculty. The graduate assistant will work in direct support of course and lab instruction and will assist students on a regular basis in accordance with a load assigned by his or her department. Recipients are selected by the department on the basis of academic record and departmental need. Applications for graduate assistantships are available in the department and on the web, and should be submitted before the deadline announced by the department to the departmental office. The stipend received is considered employment income and is subject to employment-related taxes in Lebanon. Tuition waiver is not subject to taxes.

3.1.2 Graduate Research Assistant (GRA)

Graduate research assistants, in addition to their instructional appointments, are employed to support the research of a faculty member in a capacity that enhances the student's career and educational development. GRAs are paid a stipend from the research funds of faculty members and grants to supplement or replace the instructional stipend, in return for teaching related assignments up to the limit set by the University. Research duties vary depending on the type of research project and may include laboratory experiments, library searches, data entry, preparation of reports, and other relevant assignments. The stipend received is considered employment income and is subject to employment-related taxes in Lebanon unless the stipend is awarded through fellowship.

3.1.3 Eligibility and Application Process

The general eligibility criteria for appointment to GA or GRA positions are:

- The student must be admitted to, or enrolled, in a graduate program.
- The student must be in good academic standing at AUB. A student on probation may not hold a graduate assistantship.
- A student who is appointed as a full-time graduate assistant at AUB must not be engaged in any other employment commitments.
A student is not permitted to hold a graduate assistantship at AUB concurrently with an assistantship at any other university.

Graduate assistants who are assigned primary responsibility for lab instruction or teaching tutorial sessions must have fulfilled the graduate English language proficiency requirements as specified in the AUB Graduate Catalogue.

The following rules apply to graduate assistants (GAs) and graduate research assistants (GRAs):

- GAs and GRAs must be full-time students.
- GAs and GRAs are assigned to individual faculty members by the chairperson of the department.
- GAs and GRAs may receive full or partial support, as specified in their contract. Full-support for a GA is defined as 9 credit hours, plus the GA stipend as set by the University, for which the full-time GA works 20 hours per week. A 2/3 GA is defined as 6 credit hours, plus the corresponding GA stipend as set by the University, for which the 2/3 GA works 14 hours per week. A 1/2 GA is defined as 4.5 credit hours, plus the corresponding GA stipend as set by the University, for which the half-time GA works 10 hours per week. A 1/3 GA is defined as 3 credit hours, plus the corresponding GA stipend as set by the University, for which the 1/3 GA works 7 hours per week.
- GRA stipends and tuition support come from grants, either from the University Research Board (URB) or through external grant support. They supplement or substitute for the regular graduate assistantships and provide additional tuition or stipend support up to the limit set by the University.
- The duties of GAs concentrate on teaching or teaching support such as:
  - Assisting students during laboratory sessions
  - Grading of homework assignments, lab reports, projects, and tests
  - Proctoring exams
  - Assisting in the administration of the Instructor Course Evaluation (ICE)
Preparing course files and course notes
Preparing and developing laboratory experiments

- GAs and GRAs will be assigned office space and are expected to show-up for work on a full-time basis and continuously report to their faculty supervisor.

- Students awarded graduate (research) assistantships are prohibited from working outside the department. They will not be entitled to receive other financial aid as long as the GA or GRA is in force. They may be terminated with one month notice at any time their performance is considered, at the sole discretion of the department, to be unsatisfactory.

3.1.4 Research Assistantships (RA)

Research Assistantships (RAs) are granted by faculty members to academically qualified individuals who are primarily engaged in assisting with research projects. RAs are negotiated directly with the faculty member(s) involved. Research assistants must hold a bachelor’s degree.

Research assistants may be appointed either on a part-time or full-time basis, according to the following stipulations:

- Part-time RAs are defined as individuals whose appointments are for no more than a maximum of 50 percent of full-time appointments and on a semester basis, and may not, in any case, exceed a period of nine months. A part-time research assistant is not eligible for termination benefits or for enrollment in the health insurance plan (HIP), as per the provisions of the retirement program and HIP. If appointed at less than 50 percent time, the contract may extend beyond nine months, but not more than 11 months.

- Full-time RAs are on full-time appointments and have benefits that vary according to the duration of their contracts. Those who have contracts for a period of more than three months are entitled to join the HIP program. However, to benefit from the reduction of tuition fees (for oneself) accorded to other full-time employees as part of the staff education benefit; the contract must be for a period of at least one year. Termination benefits under “Plan B” and the staff education benefits must be budgeted in the grant or through other funds.
3.1.5 **Maximum Duration of GA and Fellowship Support**

The maximum length for receiving GA support (from all sources of funding) is limited to four regular semesters and one summer.
4. PhD in Electrical and Computer Engineering

4.1.1 Objectives

The objectives of the program are to

• provide the student with the research opportunities to acquire a depth of knowledge in one specialization area of electrical and computer engineering, and familiarity with allied areas;
• provide opportunities for the doctoral student to develop competence in performing independent research, communicating effectively, and learning independently;
• advance the state of electrical and computer engineering research at AUB, in Lebanon, and the region; and
• advance the state of the art in electrical and computer engineering.

4.1.2 English Language Proficiency requirement (ELPR)

Refer to page 14 Table 3

4.1.3 Admission Requirements

Applicants to the PhD program must hold a master’s degree in electrical and computer engineering or in a related discipline from AUB or another recognized institution of higher education, with a minimum cumulative average of 85.0 over 100 or its equivalent. For an application to be complete, it must include:

• Transcripts of academic record from the institution(s) of higher education attended by the applicant

• Graduate Record Examination (GRE) general test scores

• An applicant’s written statement of purpose

• Three letters of recommendations

• A portfolio that includes a resume and samples of work

• An interview, conducted either in person, by phone, or over the Internet with the ECE Graduate Committee (EGC).

All applicants must also satisfy the University requirements for admission to PhD programs.
4.1.4 Course Requirements

The completion of at least forty-eight (48) credits of graduate study consisting of combined course work and research beyond the master’s degree is required for the PhD degree in Electrical and Computer Engineering. A minimum of eighteen (18) credits of course work and a minimum of eighteen credits (18) of research and thesis work are required the remaining credits can be from either major or minor courses or research.

The basic program of study for the PhD degree is built around: one major area and a minimum of one minor area. Students take courses to satisfy the major and minor area requirements and to acquire the knowledge needed for the Qualifying Exam Part I and Qualifying Exam Part II.

- The major area can be in one or a combination of two of the ECE areas.
- Nine credits of core courses must be taken in the major area
- Students must take at least six graduate courses, including courses prior to admission to the PhD program, in their PhD major area.
- Students must also take at least three graduate courses in their PhD minor area, including courses taken prior to admission to the PhD program.
- The minor courses may be taken in one of the ECE areas
- The minor course, based on the recommendation of the advisor and approval of the ECE graduate Committee (EGC) can be from an area outside the ECE department, or a combination of courses taken in the department and outside the department.

4.1.5 Academic Evaluation

Each student must maintain an 85/100 cumulative average in order to remain in good standing. The cumulative average is calculated for courses taken beyond the master’s degree.

Students placed on probation during regular status residency

- A student is placed on probation if s/he attains a cumulative average of 75 or more, but less than 85.
- A student is placed on probation if s/he fails any course (below 70) taken for graduate credits. (This rule does apply to the first term of study).
A student placed on probation due to course failure must retake the course the next time it is offered and pass the course. In case where this condition cannot be met, the student in consultation with the adviser must petition the ECE graduate committee (EGC) and Faculty/School Graduate Studies Committee.

This probation must be removed at the end of the following term by attaining a cumulative average of at least 85.

**Dismissal**

- A student is dropped from the PhD program, if s/he fails to remove the probation.
- A student is dropped from the PhD program, if s/he receives probation for a second time during the degree residency.
- A student is dropped from the PhD program if s/he attains a cumulative average of 75 or more, but less than 85, in any term and fails one course in that term. (This rule does not apply to the first term of study.)
- A student is dropped from the PhD program if s/he attains a cumulative average of less than 75 or fails two courses in one term.
- A student is dropped from the PhD program if the work of the student is considered to be unsatisfactory in the opinion of the department or program, regardless of the grades obtained.
- A student is dropped from the PhD program if s/he fails the Qualifying Examination Part I (Comprehensive Examination) or Part II (Thesis Proposal Defense) twice.
- A student is dropped from the PhD program if s/he fails the thesis defense twice.
- A student is dropped from the PhD program if s/he accumulates two consecutive failures in the seminar course.

A student dropped from the PhD program will not be allowed to re-enroll in the same program at any future date.

### 4.1.6 PhD Qualifying Exam

All PhD students are required to pass the qualifying exam. The PhD qualifying exam is two parts. Qualifying Exam Part I is a written comprehensive exam administered by the department/program. The Qualifying Exam Part II is an oral thesis proposal defense exam administered by the thesis committee.
4.2.6.1 Qualifying Exam Part I: Comprehensive Exam

Comprehensive examinations are written exams taken after completing a minimum of 12 credits of course requirements for the regular degree track. Timing of the examination is set by the department/program no later than the fourth regular semester of the PhD student’s enrolment.

All PhD students are required to register (EECE 900) and take the Qualifying Exam Part I: Comprehensive Exam. This exam is given twice a year, at the end of the fall and spring semesters. Students are informed beforehand of the subjects that will be covered in the examination. Students who do not pass may repeat the exam only once, during the following regular semester. Students who pass the comprehensive exam after one failure will have their initial failure deleted and replaced by the passing comprehensive record showing on their transcript. If the student does not pass the exam after his/her 2nd attempt s/he will be asked to discontinue his/her PhD studies.

Each student must declare two exam areas, one is his/her major area and one is his/her minor area.

These two exams can be taken separately in at different times/dates during the same examination period which is set during the last teaching week of the semester.

Major area:
The exam consists of six questions and the student is required to answer four of them. The questions are submitted by the area committee. The duration of the exam is no less than 3 hours.

Minor area:
The exam consists of six questions and the student is required to answer two of them. The questions are submitted by the area committee. The duration of the exam is 2 hours.

Passing the Comprehensive exam requires an average of no less than 80/100; with no less than 80/100 in the major area and no less than 70/100 in the minor area.

It should be noted that each exam area is designed to evaluate the student’s understanding of the fundamentals in the area.
4.1.7 Dissertation Committee

In accordance to the Lebanese Ministry of Higher Education, the dissertation committee should be composed of at least five faculty members:

- Chair of the committee, advisor, and at least one member from the student’s department/program
- Two members must be from outside the university
- At least four committee members must be from the student’s major area
- All members must hold doctoral degrees
- The advisor and at least three of the members must be of professorial rank
- The chair of the thesis committee must be a full professor and cannot be the advisor.

Members of the committee are recommended by the student’s thesis advisor and approved by Graduate Studies Committee of the ECE department, the FEA Graduate Studies Committee, and the Board of Graduate Studies.

The committee approves the thesis topic, research plan, conducts the oral Qualifying Exam (Part II), and conducts the thesis defense. The thesis proposal and the selection of the committee should be approved at least two semesters before the student defends his/her thesis.

Any changes in the committee, including the thesis advisor, are possible with the approval of the EGC, FEA GSC, and BGC.

4.2.7.1 Qualifying Exam Part II: Defense of Thesis Proposal

Within two semesters after passing the comprehensive examination, the student must take the Qualifying Exam Part II: Defense of Thesis Proposal conducted by his/her dissertation committee. The defense of the PhD thesis proposal is considered a part of the qualifying examination. In addition to reviewing the prospectus of the dissertation, the nature and the content of the examination are related to the student’s field of research.

4.1.8 Admission to Candidacy

Students must be admitted to candidacy at least two semesters before obtaining the PhD degree. For admission to candidacy, students are expected to have
• submitted a program approved by the dissertation committee, the EGC, the FEA GSC, and the BGS

• passed the Qualifying Exam Part I and Part II

• completed at least 15 credits of graduate course work beyond the master’s degree

• attained a cumulative average of at least 85.0 in all courses taken beyond the master’s degree

• maintained good academic standing.

4.1.9 PhD Dissertation
The student must submit a dissertation based on the results of original, independent research. The PhD dissertation is expected to make a significant contribution in electrical and computer engineering. Upon completion of the dissertation and after its approval by the dissertation advisor, the dissertation must be defended orally.

4.1.10 Dissertation Defense
The dissertation defense is open to the public and must be scheduled no later than October 30, March 1, and June 10, for students who wish to graduate at the end of the fall, the spring semester, or the summer session respectively. “Pass” or “Fail” is reported for the combined dissertation and dissertation defense. If “Fail” is reported, the student may resubmit the dissertation and defend it after a period of at least three months. Failure on the second attempt results in the discontinuation of graduate work.

A student must be registered for the dissertation in the term session in which s/he expects to graduate.

4.1.11 Residence Requirements
The student must register for at least four semesters beyond the completion of the master’s degree. Requirements for the PhD degree must be completed within a period of five years after starting graduate work beyond the master’s degree. Extension beyond the five-year limit requires the approval of the EGC, FEA GSC, and BGS.
4.1.12 Seminar Requirements

Students must register for EECE 797 – Seminar, as long as they are in the program.

4.1.13 Program Completion Requirements

To earn the PhD degree in electrical and computer engineering, the student must complete the following requirements:

- Have at least one journal paper, based on the PhD dissertation, accepted in a leading international journal in his or her field of specialty that requires at least two reviews. Additionally at least two refereed conference papers, based on the dissertation, must have appeared in conference proceedings.

- Have a cumulative average, beyond the master’s degree, of 85.0 or above, and be in good academic standing

- Satisfy the course and research credit requirements

- Passed the Qualifying Exam Part I and Part II

- Complete and successfully defend a PhD dissertation

- Satisfy the residence requirement and all other pertinent AUB regulations

4.1.14 PhD Major and Minor Areas

- The PhD major and minor areas with their corresponding courses are the following:

**Applied Electromagnetics and RF Systems Area**

**Core Graduate Courses**
EECE 613: RF and Microwave Circuits for Communications
EECE 680: Antenna Theory and Design
EECE 682: Time-Harmonic Electromagnetic Field

**Elective Graduate Courses**
EECE 643: RF System Engineering for Wireless Communications

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1 A course can be listed under more than one area, but it will not count more than once.
EECE 681: Advanced Antenna Design
EECE 683: Numerical Analysis in Electromagnetics

**Biomedical Engineering Area**

**Core Graduate Courses**
- EECE 601: Biomedical Engineering I
- EECE 602: Biomedical Engineering II
- EECE 603: Biomedical Signal and Image Processing

**Elective Graduate Courses**
- EECE 605: Neuroengineering I
- EECE 661: Robotics
- EECE 667: Pattern Recognition
- EECE 693: Neural Networks
- EECE 694: Digital Image Processing

**Communications Area**

**Core Graduate Courses**
- EECE 640: Wireless Communications
- EECE 641: Information Theory
- EECE 646: Advanced Digital and Data Communications

**Elective Graduate Courses**
- EECE 604: Communications Engineering for Genetics and Bioinformatics
- EECE 642: Introduction to Coding Theory
- EECE 643: RF Systems Engineering for Wireless Communications
- EECE 644: Stochastic Processes, Detection and Estimation
- EECE 645: The UMTS Cellular System
- EECE 691: Digital Signal Processing
- EECE 694: Digital Image Processing
- EECE 695: Adaptive Filtering

**Computer Architecture and VLSI Circuits Area**

**Core Graduate Courses**
- EECE 611: Introduction to Analog VLSI Systems
- EECE 612: Digital Integrated Circuits
- EECE 616: Advanced Digital Integrated Circuits
- EECE 621: Advanced Computer Architecture
- EECE 623: Reconfigurable Computing

**Elective Graduate Courses**
- EECE 613: RF and Microwave Circuits for Communications
EECE 614: Computer Aided Analysis and Design of VLSI Circuits and Systems
EECE 615: Computer Methods for Circuit and System Simulation
EECE 622: VLSI for Communications and Signal Processing
EECE 624: Digital Systems Testing
EECE 625: Embedded Systems Design

**Control Systems Area**

**Core Graduate Courses**
EECE 660: System Analysis and Design
EECE 661: Robotics
EECE 663: System Identification

**Elective Graduate Courses**
EECE 662: Optimal Control
EECE 665: Adaptive Control
EECE 667: Pattern Recognition
EECE 664: Fuzzy Sets, Logic, and Applications.
EECE 693: Neural Networks

**Energy and Power Systems Area**

**Core Graduate Courses**
EECE 670: Power System Planning
EECE 675: Renewable Energy Systems
EECE 678: Advanced Power Systems Analysis

**Elective Graduate Courses**
EECE 671: Environmental Aspects of Energy Systems
EECE 672: Energy Policy and Planning
EECE 673: Power Electronics Systems and Applications
EECE 677: Electric Power System Control and Stability
EECE 798A: Special Topics in High Voltage Transmission Systems
EECE 798B: Special Topics in Generation Operation and Control

**Machine Intelligence Area**

**Core Graduate Courses**
EECE 633: Data Mining
EECE 664: Fuzzy Sets, Logic, and Applications
EECE 667: Pattern Recognition
EECE 693: Neural Networks

**Elective Graduate Courses**
EECE 631: Advanced Topics in Algorithms
EECE 639: Advanced Data Mining  
EECE 661: Robotics  
EECE 662: Optimal Control  
EECE 663: System Identification  
EECE 665: Adaptive Control  
EECE 668: Game Theory and Decision Making  
EECE 694: Digital Image Processing  
EECE 695: Adaptive Filtering

**Networks and Security Area**  
**Core Graduate Courses**  
EECE 632: Cryptography and Computer Security  
EECE 651: Internet Engineering  
EECE 653: Multimedia and Networking  
EECE 655: Internet Security  
EECE 656: Mobile Ad hoc and Sensor Networks  
EECE 657: Wireless Network Security

**Elective Graduate Courses**  
EECE 630: Distributed and Object Databases  
EECE 640: Wireless Communications  
EECE 647: Queuing Theory  
EECE 652: Web Server Design and Programming  
EECE 654: Pervasive Computing

**Signal and Image Processing Area**  
**Core Graduate Courses**  
EECE 603: Biomedical Signal and Image Processing  
EECE 691: Digital Signal Processing  
EECE 694: Digital Image Processing  
EECE 695: Adaptive Filtering

**Elective Graduate Courses**  
EECE 644: Stochastic Process, Detection and Estimation  
EECE 663: System Identification  
EECE 667: Pattern Recognition  
EECE 693: Neural Networks  
EECE 696: Applied Parallel Programming

**Software Engineering Area**  
**Core Graduate Courses**  
EECE 631: Advanced Topics in Algorithms
EECE 636: Analysis and Verification of Software
EECE 637: Advanced Programming Practice
EECE 638: Software Testing

Elective Graduate Courses
EECE 630: Distributed and Object Database Systems
EECE 632: Cryptography and Computer Security
EECE 652: Web Server Design and Programming
EECE 654: Pervasive Computing Systems and Applications
EECE 696: Applied Parallel Programming
EECE 732: Pseudo Randomness
## 5. Research Areas in the ECE Department

### Research Areas in the ECE Department

<table>
<thead>
<tr>
<th>Faculty member</th>
<th>Research Interests</th>
</tr>
</thead>
</table>
| Ibrahim Abou Faycal     | • Information theory  
                          | • Digital and optical communications  
                          | • Stochastic systems          |
| M. Adnan Al-Alaoui      | • Analog and digital signal processing with applications to filters, communications,  
                          | controls, and biomedical engineering  
                          | • Pattern recognition and neural networks  
                          | with applications to character, speech, and  
                          | image recognition          |
| Haitham Akkary          | • Computer architecture  
                          | • Optimizing compilers  
                          | • Configurable computing  
                          | • Embedded systems design          |
| Hassan Artail           | • Distributed and mobile computing  
                          | • Wireless and emerging networks  
                          | • Mobile ad-hoc and vehicle ad-hoc networks  
                          | • Data knowledge and engineering          |
| Mariette Awad           | • Pattern recognition  
                          | • Artificial intelligence and game theory  
                          | • Machine learning in power aware  
                          | computing  
<pre><code>                      | • Intelligent systems and control          |
</code></pre>
<table>
<thead>
<tr>
<th>Name</th>
<th>Research Interests</th>
</tr>
</thead>
</table>
| Louay Bazzi  | • Theory of error correcting codes  
• Design and analysis of algorithms  
• Cryptography, number theory, and complexity theory |
| Farid Chaaban| • Design and analysis of electric machines and drives  
• Energy systems and their impact on the environment  
• Air pollution from power plants |
| Riad Chedid  | • Energy policy, planning, and modeling  
• Design and planning aspects of renewable energy systems  
• Computer-aided design of electromagnetic/electromechanical devices  
• Design and operation of electric drives |
| Ali Chehab   | • Information security  
• Energy-aware computing  
• Fault modeling  
• Transient current VLSI testing |
| Zaher Dawy  | • Distributed and cooperative wireless communications  
• Cellular technologies (UMTS/HSPA, LTE, WiMAX)  
• Radio network planning and optimization  
• Multimedia transmission over communication networks  
• Computational biology and bioinformatics |
| Hassan Diab | • Performance evaluation of parallel processing systems and parallel applications |
- Performance analysis of reconfigurable architectures for cryptographic algorithms
- Simulation using fuzzy logic control
- Engineering education and educational development

Ali El-Hajj
- Antenna theory
- Electromagnetic field computations
- Software development
- Telecommunication applications

Imad Elhajj
- Internet security
- Robotics and teleportation
- Instrumentation (medical and environmental devices)
- Networking and sensor networks

Hazem Hajj
- Data mining algorithms and applications
- Wireless communications
- Image processing
- High performance computing

Ibrahim Hajj
- Design and verification of VLSI circuits and systems
- Design for reliability and optimization
- Design automation
- Mixed-mode simulation
- Fault simulation and testing

Rabih Jabr
- Mathematical optimization techniques
- Power system analysis, computing, and economics
- Electric power applications
<table>
<thead>
<tr>
<th>Name</th>
<th>Research Areas</th>
</tr>
</thead>
</table>
| Karim Kabalan      | • Antenna theory  
                   • Electromagnetic field computations  
                   • Software development.  
                   • Telecommunication applications |
| Sami Karaki        | • Renewable energy systems modeling  
                   • Generation expansion planning and production costing  
                   • Application of neural networks, fuzzy systems, and genetic algorithms in energy system |
| Fadi Karameh       | • System identification and control  
                   • Biological systems: neural system modeling, gene expression arrays  
                   • Signal processing |
| Ayman Kayssi       | • Information security  
                   • Low-power design  
                   • Energy-aware computing  
                   • Internet engineering |
| Mohammad Mansour   | • VLSI for signal processing and communications  
                   • Coding theory, iterative channel decoding, codes on graphs  
                   • VLSI optimizations using methods from abstract algebra  
                   • Digital IC design |
| Wassim Masri       | • Dynamic software analysis  
                   • Automated software testing  
                   • fault localization and program debugging |
Jean Saade
- program comprehension
- software security
- software engineering
- Communication systems
- Fuzzy sets and logic
- Design of intelligent systems using fuzzy logic and other tools
- Optimization techniques for intelligent and decision-making systems

Nassir Sabah
- Computation in the central nervous system
- Biomedical instrumentation
- Development and implementation of engineering and technology curricula
- Static and dynamic analysis of software, formal verification
- Programming languages

Fadi Zaraket
- Parallel computation
- Software engineering
- Computational Arabic and Arabic natural language processing
6. Graduate Courses

EECE 601  Biomedical Engineering I  3 cr.
This course includes an introduction to: general instrumentation configuration, performance of instrumentation systems; types and characteristics of transducers; sources and characteristics of bioelectric signals; types and characteristics of electrodes; temperature regulation and measurement; cardiovascular system, measurements, and diagnostic equipment; blood instruments; patient care and monitoring; and electrical safety of medical equipment. Prerequisites: EECE 210 and BIOL 210 or consent of the instructor.

EECE 602  Biomedical Engineering II  3 cr.
This course covers respiratory system and measurements; nervous system and measurements; sensory and behavior measurements; biotelemetry; instrumentation for the clinical laboratory; x-rays and radioisotope instrumentation; magnetic resonance; and special surgical techniques. Prerequisite: EECE 601 or consent of the instructor.

EECE 603  Biomedical Signal and Image Processing  3 cr.
A course that introduces the fundamentals of digital signal processing as implemented in biomedical applications. It provides a concise treatment of the tools utilized to describe deterministic and random signals as the basis of analyzing biological signals: data acquisition; imaging; denoising and filtering; feature extraction; modeling. The course is tightly coupled with a practical component as it looks at and assigns several laboratory projects. Examples include the auditory system, speech generation, electrocardiogram, neuronal circuits, and medical imaging. Students should have reasonable software skills in Matlab. Prerequisites: STAT 230 and EECE 340, or equivalent.

EECE 604  Communications Engineering for Genetics and Bioinformatics  3 cr.
This course presents current research efforts in the emerging interdisciplinary field of communications engineering for genetics and bioinformatics. It shows how concepts and techniques from the field of communications engineering can be applied to central problems from the fields of genetics and bioinformatics. As a basic analogy, voice information is digitized, transmitted, and processed in communications, and DNA information is replicated, transmitted, and processed in genetics. The main topics covered include DNA compression, mutual information for functional genomics, channel coding for gene expression, genomic signal processing, and biological computation.

EECE 605  Neuroengineering I  3 cr.
A course that focuses on the importance of biological systems from the engineering viewpoint; living cells and mechanisms; introduction to the nervous system; the resting membrane potential; generation and propagation of the action potential; motor systems; synaptic transmission; control of movement. Prerequisite: BIOL 210 or consent of instructor.
EECE 611  Introduction to Analog VLSI Systems  3 cr.
This course covers an introduction to digital electronic circuits; models, current equations and parasitic of CMOS transistors for digital design; study of CMOS inverter and logic gates, including analysis, design, simulation, layout and verification; advanced circuit styles; sequential circuits; advanced topics: semiconductor memories, power grid, clocking strategies, datapath building blocks, deep-submicron design issues, and interconnect. Prerequisites: EECE 310 and EECE 320 or consent of the instructor.

EECE 612  Digital Integrated Circuits  3 cr.
A course on digital electronic circuits; models, current equations, and parasitics of CMOS transistors for digital design; study of CMOS inverter and logic gates, including analysis, design, simulation, layout, and verification; advanced circuit styles; sequential circuits; advanced topics: semiconductor memories, power grid, clocking strategies, datapath building blocks, deep-submicron design issues, interconnect. Prerequisites: EECE 311 and EECE 320 or consent of the instructor.

EECE 613  RF and Microwave Circuits for Communications  3 cr.
The course focuses on the analysis and design of high-frequency electronic circuits, with emphasis on RF and microwave circuits and components for communication systems. The course covers the basic principles of radio-frequency (RF) and microwave circuits design, as applied to the design of microstrip and coplanar lines, impedance transformers, low-pass and band-pass filters, directional couplers, power dividers, amplifiers, mixers, and diode detectors. It provides understanding of S-parameters and signal-flow graph analysis techniques. The course enables the student to get hands-on experience in RF and microwave circuit design through the use of computer-aided design tools to simulate and analyze high frequency circuits, build them as part of a course project, and perform measurements in the lab using network and spectrum analyzers. Prerequisites: EECE 311, EECE 340, and EECE 380 or consent of the instructor.

EECE 614  Computer-Aided Analysis and Design of VLSI Circuits and Systems  3 cr.
A course on circuit and logic simulation; timing analysis and verification; testing and fault simulation; logic and high-level synthesis; physical design automation. Prerequisite: EECE 311 or consent of the instructor.

EECE 615  Computer Methods for Circuit and System Analysis  3 cr.
This course covers numerical methods and techniques for computer simulation of linear and nonlinear circuits and systems. This includes formulation methods, solution of linear equations and systems (DC analysis or static analysis), time-domain solution (transient analysis), solution of large systems, and sensitivity analysis. Application areas include simulation of electronic integrated circuits, power systems, electro-mechanical systems, mechatronics, and systems that can be modeled by sets of algebraic-differential equations. Prerequisites: EECE 210, MATH 202, and MATH 218 or 219 or consent of the instructor.
EECE 616  Advanced Digital Integrated Circuits  3 cr.
A graduate level course on advanced digital integrated circuits. The following topics are covered: impact of physical technology on architecture; technology issues: CMOS scaling and issues in deep submicron regimes, process variations; device and interconnect modeling; optimization for speed; high-speed logic families; low-power design: leakage reduction techniques, voltage scaling; power distribution; clocking strategies; timing concepts; memory design: clocked storage elements, SRAM, DRAM, flash memory; and high-speed arithmetic circuits. Prerequisite: EECE 412 or EECE 612 or consent of the instructor.

EECE 621  Advanced Computer Architecture  3 cr.
This course focuses on modern advancements in parallel computer architecture, with emphasis on advanced instruction level parallelism (ILP) and multiprocessor architectures. Topics include: advanced branch prediction, data speculation, computation reuse, memory dependence prediction, trace caches, dynamic optimizations, checkpoint architectures, latency-tolerant processors, simultaneous multithreading, speculative multithreading, virtual machines, message passing multiprocessors, UMA, NUMA and COMA shared-memory multiprocessors, single-chip multiprocessors, wormhole routing techniques, cache coherence, memory consistency models, high performance synchronization methods, speculative lock elision and transactional memory. A key component of the course is a research project in which students use architecture performance simulator to investigate novel architecture techniques. Prerequisite: EECE 421 or consent of the instructor.

EECE 622  VLSI for Communications and Signal Processing  3 cr.
This course introduces concepts in the design and implementation of digital signal processing systems using integrated circuits. The main emphasis is on the architectural exploration, design and optimization of signal processing systems for communications. Algorithm, architecture, and circuit design techniques are introduced that enable joint optimization across the algorithmic, architectural, and circuit domains. A key component of the course is a project in which students investigate problems in the design and implementation of low-power and high-performance communication systems.

EECE 623  Reconfigurable Computing  3 cr.
A course dealing with the design issues pertaining to the implementation of application specific architectures using the reconfigurable computing paradigm allowing the same circuit to be reused in order to run different applications. Emphasis is on the systematic design of reconfigurable computing platforms that exploit a high degree of parallelism. Prerequisite: EECE 321 or consent of instructor.

EECE 624  Digital Systems Testing  3 cr.
This course covers an overview of digital systems testing and testable design; test
economics, fault modeling, logic and fault simulation, testability measures, test generation for combinational circuits, memory test, delay test, IDDQ test, scan design, and boundary scan. Prerequisite: EECE 320 or consent of the instructor.

EECE 625  Embedded Systems Design  3 cr.
A course on embedded hardware and software design; the system design process: requirements analysis, specification, hardware/software co-design, testing; embedded computing platforms: general- and special-purpose processors, hardware accelerators, systems-on-a-chip, intellectual property (IP) core-based design, embedded networks; software design tools and technologies: CAD tools, compilers, and assemblers; hardware design tools and technologies: hardware-description languages, high-level synthesis tools, ASIC and FPGA design flows; real-time operating systems: multiple tasks and processes, context switching, task scheduling, interprocess communication mechanisms; low-power computing: circuit, architecture, and application techniques; system reliability and fault tolerance. Prerequisites: EECE 321 and EECE 321L or consent of the instructor.

EECE 630  Distributed and Object Database Systems  3 cr.
A course that covers design techniques used for distributing databases among multiple sites. The fundamental topics include fragmentation, replication, and allocation. The course also discusses the strategies used in executing distributed queries subject to given criteria and the commit protocols for managing transactions in a distributed environment. Other topics covered include parallel database implementations and the design of object database management systems. The course enables students to get hands-on experience in designing distributed database systems using a design project that requires the implementation of low-level functionality associated with the functions of distributed database system. Prerequisite: EECE 433 or consent of the instructor.

EECE 631  Advanced Topics in Algorithms  3 cr.
This is a second course on the general principles of algorithm design and analysis. The course is a continuation of EECE 431. Topics include: computability theory; complexity theory: time complexity, P versus NP, circuit complexity, and space complexity; randomized algorithms; linear programming; approximation algorithms; and selected topics. Prerequisite: EECE 431 or consent of the instructor.

EECE 632  Cryptography and Computer Security  3 cr.
This course includes an overview of encryption and computer security; classical encryption techniques, block ciphers and the data encryption standard, finite fields, advanced encryption standard, confidentiality using symmetric encryption, public-key cryptography, key management, hash and MAC algorithms, digital signatures, authentication applications, email security, and Web security or consent of the instructor.
EECE 633  Data Mining  3 cr.
This course is an introduction to data mining. Data mining refers to knowledge discovery from huge amounts of data to find non-trivial conclusions. Topics will range from statistics to machine learning to database, with a focus on analysis of large data sets. The course will target at least one new data mining problem involving real data, for which the students will have to find a solution. Prerequisite: EECE 433 or consent of the instructor.

EECE 636  Analysis and Verification of Software  3 cr.
This course introduces the basics needed to understand automation techniques for the verification of computing systems. It also introduces modern programming practices such as aspect oriented programming and design patterns. Various state-of-the-art design and validation techniques will be discusses as well as their application to modern programming practices. The students will have the chance to practice and possibly advance these techniques in projects that will expose them to modern software engineering practices such as eXtreme and Agile programming. Prerequisite: EECE 330 or consent of the instructor.

EECE 637  Advanced Programming Practice  3 cr.
This course is an advanced course on programming practices with a focus on verification. The course introduces programming tools and techniques that make individual engineers more effective and productive and help them develop quality code. Teams will work in Agile and eXtreme programming environments with a focus on design by contract. They will use formal specifications, design patterns and aspect oriented programming. Projects will use tools for code control, building, configuration, language recognition, dynamic documentation, fast prototyping, refinement, coverage, automated and manual debugging, and dynamic and static verification. Prerequisite: EECE 330 or consent of the instructor.

EECE 638  Software Testing  3 cr.
The course focuses on concepts, techniques and tools for testing software. It provides practical knowledge of a variety of ways to test software and an understanding of some of the tradeoffs between testing techniques. The topics include: software testing at the unit, module, and system levels; functional and structural testing; regression testing; mutation testing; test suite minimization and prioritization; automatic test case generation. Prerequisite: Senior or graduate standing.

EECE 639  Advanced Data Mining  3 cr.
A course that covers advanced topics in data mining and recent progress in this field. Discussions will include which techniques fit best for complex applications in data mining. Mining complex data will include general text mining, Arabic text mining, social network analysis, spatial data mining, mining of the World Wide Web, stream data, time-series data, and sequence data. We will also discuss recent application
sectors and trends in data mining such as for the telecommunication, biological, and financial sectors. Prerequisites: EECE 330, and one of the following EECE 633, EECE 667, or EECE 693 or consent of the instructor.

EECE 640  Wireless Communications  3 cr.
A course that covers the fundamentals of wireless communications with emphasis on wireless channel modeling; digital modulation in wireless channels; diversity techniques; channel coding and interleaving in fading channels; adaptive equalization; multiple access techniques; the cellular concept; overview of current wireless communications systems. Prerequisite: EECE 442 or consent of the instructor.

EECE 640L  Wireless Communications Laboratory  1 cr.
A laboratory course that covers the following topics: basics of radio network planning and optimization, radio network planning for the GSM cellular system, radio network planning for the UMTS cellular system, GSM-UMTS co-existence and co-citing, radio network planning for the WiMAX broadband system, indoor GSM drive testing measurements and analysis, outdoor GSM drive testing measurements and analysis, UMTS drive testing measurements and analysis, and measurement-based wireless channel modeling. Prerequisite: EECE 640 or consent of the instructor.

EECE 641  Information Theory  3 cr.
In this course students study “data transmission” through introducing the field of information theory. The theory is introduced in a gradual fashion and students study its applications to communications theory, computer science, statistics and probability theory. Covering all the essential topics in information theory, students are introduced to the basic quantities of entropy, relative entropy, and mutual information to show how they arise as natural answers to questions of data compression, channel capacity, rate distortion and large deviation theory. Prerequisite: STAT 230 or EECE 442 or consent of the instructor.

EECE 642  Introduction to Coding Theory  3 cr.
This course introduces the theory of error-correcting codes with a focus on the asymptotic, algorithmic, and algebraic aspects. Topics include: background material from combinatorics and algebra; Shannon's coding theorem; linear codes; coding bounds; classical algebraic codes: Hamming and Hadamard codes, Reed-Solomon codes and Justesen codes, and decoding algorithms; codes from graphs: low density parity check codes, expander codes, explicit constructions, and decoding algorithms; and an introduction to Turbo codes. Prerequisite: Senior or graduate standing.

EECE 643  RF System Engineering for Wireless Communications  3 cr.
This course introduces students to system blocks, system parameters, and architectures of RF systems for wireless communications. It focuses on the design of a radio system for transmission and reception of voice and data information: receivers and transmitters.
system topologies, key system blocks in a wireless system, determination of system block parameters from radio requirements and system analysis, tradeoffs between various blocks in a radio system, and frequency planning. It discusses how modulation and demodulation schemes and multiple-access techniques used in present wireless applications influence RF systems requirements. The last part of the course focuses the link budget analysis of RF radio links. Prerequisites: EECE 311, EECE 380, and EECE 442 or consent of the instructor.

**EECE 644  Stochastic Processes, Detection, and Estimation**  
This is a graduate-level introduction to the fundamentals of detection and estimation theory involving signal and system models in which there is some inherent randomness. The concepts that we develop are extraordinarily rich, interesting, and powerful, and form the basis for an enormous range of algorithms used in diverse applications. The material in this course constitutes a common foundation for work in the statistical signal processing, communication, and control areas. Prerequisites: STAT 230 and EECE 340 or consent of the instructor.

**EECE 645  The UMTS Cellular System**  
A course on the evolution of cellular technologies; UMTS standardization and services; WCDMA transmitter and receiver link level design; access and core network architectures; physical channels and signaling procedures; power control and soft/softer handover; capacity/coverage tradeoffs and cell breathing; capacity/coverage enhancement techniques; antenna diversity and MIMO techniques; multiuser detection techniques; high speed packet access (HSDPA and HSUPA); and basic principles of LTE. Prerequisite: EECE 640 or consent of the instructor.

**EECE 646  Advanced Digital and Data Communications**  
A course that addresses digital communication principles and techniques aimed at achieving improved reliability. The course examines information measures; such as entropy and mutual information for discrete and waveform channels, source coding, channel capacity and coding theorem, linear block and cyclic codes, hard and soft decision decoding, spread spectrum modulation.

**EECE 647  Queuing Theory**  
A course that covers Poisson counting and renewal processes; Markov chains and decision theory, branching processes, birth death processes, and semi-Markov processes; simple Markovian queues, networks of queues, general single and multiple-server queues, bounds and approximations. Prerequisite: Senior or graduate standing.

**EECE 651  Internet Engineering**  
A course that examines major protocols used in internet engineering: IP, ICMP, TCP, UDP; new technologies introduced on the internet, such as IP Multicast, Mobile IP, IPv6, VPNs, and quality of service; routing on the Internet; network security and
firewall design; and an overview of the application protocols such as SMTP, HTTP, RTP, and SNMP. Prerequisite: EECE 450 or consent of the instructor.

**EECE 651L Internetworking Laboratory**
1 cr.
This laboratory course covers the technologies and protocols of the internet. The experiments cover the internet protocol (IP), address resolution protocol (ARP), internet control message protocol (ICMP), user datagram protocol (UDP) and transmission control protocol (TCP), the domain name system (DNS), routing protocols (RIP, OSPF, BGP), network address translation (NAT), dynamic host configuration (DHCP), network management protocols (SNMP), and IP multicast. Prerequisite: EECE 450 or consent of the instructor.

**EECE 652 Web Server Design and Programming**
3 cr.
This course concentrates on major technologies used in building Web servers. Alternate versions are to be given each year: the Windows-based IIS Server and the Linux-based Apache server. For IIS, ASP.NET along with C# are used for programming Web servers. For Apache, PHP is the language of choice. The course starts with a fast track on client programming, the HTTP protocol, SQL database servers, and XML programming. A weekly lab, two application projects, and a research project constitute the major requirements of the course.

**EECE 653 Multimedia and Networking**
3 cr.
This course covers topics in multimedia such as system requirements, performance requirements, representation and compression. Multimedia networking is emphasized by discussing multicasting, streaming, multimedia networking protocols and quality of service-based traffic management protocols. Other topics covered include synchronization, VoIP, and Internet 2. Multimedia networking applications are designed and implemented as student projects. Prerequisite: EECE 450 or consent of the instructor.

**EECE 654 Pervasive Computing Systems and Applications**
3 cr.
This course covers the technologies involved in integrating front-end mobile devices into local and global networks. An emphasis is placed on the underlying technologies and standards applied when building pervasive solutions. The course has a strong programming component in that it dedicates a significant portion of the time covering the development of mobile applications for three platforms: Windows CE for Pocket PCs, Palm OS for Palm PDAs, and Java 2 Micro Edition (J2ME) for wireless phones that run the Symbian OS. To emphasize this last component, code demonstrations will be held in class, and students will be required to complete three projects targeting the three platforms, designed to cover the different aspects of mobile applications (user interface, local database implementations, and networking). Prerequisite: EECE 430 or consent of the instructor.
EECE 655  Internet Security  3 cr.
The course covers topics in internet security. The course discusses security threats, vulnerabilities of protocols and the different types of attacks. Preventive and defensive mechanisms are covered; such as: e-mail security, web security, IP security, network management security, wireless security, intrusion detection techniques, firewalls, VPNs and tracing the source of attacks. The course briefly introduces the basics of cryptography and its application to network security. Student projects will be composed of implementation, simulation and research components. Prerequisite: EECE 450 and EECE 632 or consent of the instructor.

EECE 655L  Network and Computer Security Laboratory  1 cr.
A laboratory that addresses advanced network and computer security topics. Experiments include the execution of attacks, the setup of intrusion detection and prevention, securing computers and wired and wireless networks, and digital forensics. Prerequisite: EECE 655 and EECE 632 or consent of instructor.

EECE 656  Mobile Ad hoc and Sensor Networks  3 cr.
This course covers all aspects of ad hoc and sensor networking, from design through performance issues to application requirements. The course starts with the design issues and challenges that are associated with implementations of ad hoc and sensor network applications. This includes dealing with mobility, disconnections, and awareness of battery power consumption. The course then provides a detailed treatment of proactive, reactive, and hybrid routing protocols, in addition to the various clustering approaches. Next, it covers the IEEE 802.11 Wireless LAN and Bluetooth standards and discusses their characteristics and operations. The course also discusses research topics that involve collaboration among mobile devices, service discovery, and data caching. Through a project, the course gives students hands-on experience in designing a mobile ad hoc network using available Pocket PCs and simulation tools. Prerequisite: EECE 450 or consent of the instructor.

EECE 657  Wireless Security  3 cr.
A course that covers wireless network security; security challenges in wireless networks; security problems facing existing and upcoming wireless networks; security in naming, addressing, neighbor discovery, and routing; and trust and privacy. Prerequisites: EECE 450 and EECE 632 or consent of the instructor.

EECE 660  System Analysis and Design  3 cr.
A course that outlines state-space models of discrete and continuous, linear and nonlinear systems; controllability; observability; minimality; Eigenvector and transforms analysis of linear time invariant multi-input multi-output systems; pole shifting; computer control; design of controllers and observers.
EECE 661  Robotics  3 cr.
A course that examines robotic manipulators classification and work envelope; robot
kinematics, dynamics and forces; joints trajectory planning for end effector desired
tracking and constrained motion; control of robots using linear, non-linear, and
adaptive controllers. Prerequisite: EECE 460 or MECH 433 or consent of the instructor.

EECE 662  Optimal Control  3 cr.
A course on optimization theory and performance measures, calculus of variations, the
maximum principle, dynamic programming, numerical techniques, LQR control
systems.

EECE 663  System Identification  3 cr.
This course introduces the fundamentals of system identification as the basic
mathematical tools to fit models into empirical input-output data. While rooted in
control theory, applications extend to general time-series modeling and forecasting,
such as stock prices, biological data and others. Topics covered include nonparametric
identification methods: time and frequency response analysis; parametric identification
methods: prediction error methods, least squares, linear unbiased estimation and
maximum likelihood; Convergence, consistency and asymptotic distribution of
estimates; properties and practical modeling issues: bias distribution, experiment design
and model validation. Prerequisite: EECE 460 or consent of the instructor.

EECE 664  Fuzzy Sets, Logic and Applications  3 cr.
A course that outlines fuzzy sets and related concepts; logical connectives; mapping of
fuzzy sets; extension principle; fuzzy relations and fuzzy set ordering; fuzzy logic
inference; applications: fuzzy control, signal processing, pattern recognition, decision-
making, and expert systems.

EECE 665  Adaptive Control  3 cr.
A course that includes the control of partially known systems; analysis and design of
adaptive control systems; self-tuning regulators; model reference adaptive control of
uncertain dynamic systems; typical applications. Prerequisite: EECE 460 or consent of the
instructor.

EECE 667  Pattern Recognition  3 cr.
The course provides an overview of the theory, principles and algorithms used in
pattern recognition to construct high performance information processing systems that
learn from experience. The course covers traditional and modern concepts for model
selection and parameter estimation in recognition, decision making, multi-agent and
statistical learning problems. Special emphasis will be given to regression, classification,
regularization, feature selection, dimensionality reduction and density estimation in
supervised, unsupervised and semi-supervised modes of learning. Students will be
assigned typical pattern recognition problems to investigate as projects.

**EECE 668  Game Theory and Decision making  3 cr.**
Game theory provides a set of tools, approaches, and perspectives on decision making to mimic the human elements of decision making that is best described by strategy, coercion and cooperation. This course offers an introduction to fundamentals of game theory and decision making with a special emphasis on the foundations of the mathematical background. Topics covered include: static, evolutionary, supermodular, repeated, cooperative, network, potential and congestion games as well as bargaining and uncertainty in games. Students will be assigned real-world examples of game theory and strategic decision making to investigate as projects.

**EECE 670  Power System Planning  3 cr.**
A course that investigates electric energy and peak demand forecasts using weather sensitive, time curve, autoregressive and causal models; generation reliability evaluation, loss of energy expectation, energy limited units, probabilistic production costing, generating capacity expansion analysis, and maintenance scheduling; operational planning, unit commitment, Hydrothermal coordination; power system security classification, contingency analysis, external equivalents, optimal power flow; planning in a competitive electric power environment. Prequisite: EECE 471 or consent of the instructor.

**EECE 671  Environmental Aspects of Energy Systems  3 cr.**
A course that examines world energy resources and classifications; sources and effects of air pollution; air quality modeling, Gaussian dispersion models for pollution estimation; motor vehicle emissions and noise pollution; environmental impacts of electricity generation, pollution control systems, electromagnetic radiation, production and impacts in high-voltage applications; environmental impact assessment; basic concepts.

**EECE 672  Energy Planning and Policy  3 cr.**
A course that focuses on features of modern energy planning and policy. Topics covered include the interaction among the technological, economic, environmental, and sociopolitical aspects of energy supply and use; electricity, oil, and gas industries, and their market structures; elements of energy planning on the sector and national levels; energy decision-making under conditions of uncertainty, risk management in energy planning; liberalization of energy markets; case studies.

**EECE 673  Power Electronics Systems and Applications  3 cr.**
A course that reviews converter topologies for AC/DC, DC/AC, and DC/DC; power supply applications; converter applications to motor drives; utility interface of distributed energy systems; static VAR systems; flexible AC transmission; high voltage DC; power quality control; active and passive harmonics compensation. Prequisite:
EECE 473 or EECE 471 or consent of the instructor.

**EECE 675  Renewable Energy Systems**  3 cr.
A course that covers the principles of renewable energy, solar radiation, solar water heating, building and other thermal applications, photovoltaic generation, wind power, fuel cells and the hydrogen cycle, biomass, and institutional and economic factors.

**EECE 677  Electric Power System Stability and Control**  3 cr.
A course on synchronous machine modeling and simulation, response to small disturbances, and voltage instability. Topics include Park's transformation, flux linkage, voltage, and state-space equations, subtransient and transient parameters, simplified models of the synchronous machine, treatment of saturation, system reference frame, small-signal stability, power system stabilizers, and bifurcation analysis. **Prerequisite:** EECE 678, or consent of instructor.

**EECE 678  Advanced Power System Analysis**  3 cr.
A course on optimal dispatch of generation, symmetrical components and unbalanced faults, transient stability, control of generation, state estimation in power systems and power system simulation. **Prerequisite:** EECE 471 or consent of the instructor.

**EECE 680  Antenna Theory and Design**  3 cr.
This course provides the students with an understanding of the basic principles of antenna analysis and design; an overview of the fundamental characteristics and parameters of antennas; an overview of analytical and numerical methods used to analyze and design antennas with application to some basic antenna structures such as linear antennas, loop antennas, and antenna arrays. **Prerequisite:** EECE 380 or consent of the instructor.

**EECE 681  Advanced Antenna Design**  3 cr.
This course provides the students with an understanding of advanced antenna structures and presents an overview of analytical and numerical methods used to analyze and design these antenna structures. The course includes broadband antennas, frequency-independent antennas, aperture antennas, horn antennas, microstrip antennas, and reflector antennas. Students will work on a research paper on a selected antenna design topic. **Prerequisite:** EECE 680 or consent of the instructor.

**EECE 682  Time-Harmonic Electromagnetic Fields**  3 cr.
A course on time-varying and time-harmonic EM fields; electrical properties of matter; wave propagation and polarization; construction of solutions; reflection and transmission; electromagnetic theorems and principles in particular equivalence; rectangular waveguides and cavities; dielectric waveguide, circular waveguides, spherical waveguide; radiation from structures; scattering by wedges, cylinders and spheres; radiation from apertures, and perturbational and variational techniques. **Prerequisite:** EECE 380 or consent of the instructor.
EECE 683  Numerical Methods in Electromagnetics  
This course examines the principles and applications of numerical techniques for solving practical electromagnetics problems. It covers the moment methods, finite difference methods, finite element methods, and hybrid methods. The course also investigates the application of the finite-volume control method in electromagnetics.  
*Prerequisite: EECE 682 or consent of the instructor.*

EECE 691  Digital Signal Processing  
Course topics include a review of signals, systems, and transforms; design of digital filters: FIR and IIR; sampling and reconstruction of signals; multi-rate signal processing with applications; effects of finite word length; discrete random signals and spectral estimation; and an introduction to 2D signal and image processing.

EECE 691L  Digital Signal Processing Lab  
This graduate lab is comprised of a set of lab experiments in MATLAB, C and Assembly covering a series of real-time signal processing topics. The developed laboratory material is intended to complement the digital signal processing course (EECE 691). Upon completion of the lab, the student will have acquired the required knowledge and skills to develop real-time DSP systems.  
*Prerequisites: EECE 691 Digital Signal Processing (may be waived upon approval of course instructor).*

EECE 693  Neural Networks  
The course provides a comprehensive foundation to artificial neural networks and machine learning with applications to pattern recognition and data mining; learning processes: supervised and unsupervised, deterministic and statistical; clustering; single layer and multilayer perceptrons; least-mean-square, back propagation, and Al-Alaoui algorithms; radial-basis function networks; committee machines; principal component analysis; self-organizing maps; and current topics of interest.

EECE 694  Digital Image Processing  
A course on two-dimensional signals and systems; image formation and perception; representation, coding, filtering restoration, and enhancements; feature extraction and scene analysis; introduction to computer vision.

EECE 694L  Image Processing Lab  
The EECE 694L graduate lab comprises a set of MATLAB/C++ based lab experiments in different image processing topics covering image pre and post processing techniques, image compression, morphological transformations, image restoration and enhancement techniques, color image processing, computer vision basics, and geographical image processing. In addition, students will be exposed to software optimizations for real time image processing using SIMD instructions.  
*Prerequisite: EECE 694, or EECE 603, or consent of instructor.*
EECE 695  Adaptive Filtering  3 cr.
A course that examines the fundamentals of optimal filtering and estimation, Wiener filters, linear prediction, steepest-descent and stochastic gradient algorithms; frequency-domain adaptive filters; method of least -squares, recursive least squares, fast fixed order and order-recursive (lattice) filters; misadjustment, convergence and tracking analyses, stability issues, finite precision effects; connections with Kalman filtering; and nonlinear adaptive filters.

EECE 696  Applied Parallel Programming  3 cr.
This course is an introduction to parallel programming, and GPU computing. Topics include: GPU as a part of the PC architecture; CUDA, CUDA threads, and CUDA memory; floating point performance; OpenCL; MPI; and reductions and their implementation. The course also includes application case studies, current topics, and a course project. Senior or Graduate Standing, Prerequisites: EECE 321.

EECE 732  Pseudorandomness  3 cr.
Pseudorandomness is a branch of computational complexity theory whose aim is to construct randomness generators which use little randomness, but still appear random to computations with limited time, space, or circuit resources. This course covers the basics of the area of pseudorandomness. Topics include: Randomized complexity classes review; Background material from coding theory; Computational indistinguishability and pseudorandom generators; Hardness versus randomness: Nisan-Wigderson generator, Impagliazzo-Wigderson theorem; Simple generators: k-wise independence, almost k-wise Independence, and small-bias spaces; Unconditional generators for constant depth circuits, low-degree polynomials, and space-bounded computation; DNF counting algorithms; Weak random sources, randomness extractors, and Trevisan's extractor. Prerequisites: EECE 631 or consent of the instructor.

6.1  Special Courses and Thesis

EECE 700  Approved Experience for EICT students  0 cr.

EECE 796  Special Project  3 cr.
This is a graduate course given to one student. The grade in such a course will be reported as Excellent (E), Pass (P), or Fail (F), in accordance with University Regulations on Graduate Study. The course designation will be EECE 796-Special Project followed by an appropriate subtitle in brackets.

To offer a course as Special Project, the instructor giving the course must submit a proposal to the chairperson of the department for approval. The chairperson’s decision should be based on consultations with faculty members of the concerned department, or with the group of faculty members whose area of specialty is relevant to the subject matter.
Every Special Project course must have a report on the work done and the basis on which the grade was given. This report must be kept in the course file of the department.

A graduate student may take only one Special Project course during his/her graduate program. If the subject matter of the Special Project is relevant to the thesis topic, the thesis committee should take the work done into consideration in its evaluation of the thesis of the student.

**EECE 797  Seminar**  
0 cr.  
The seminar course is offered every semester by each department/graduate program on a biweekly basis.

All graduate students are required to register for the seminar course offered by their department/program in accordance with each program’s policy.

At the beginning of a semester, every department/program should issue a schedule for the seminar course showing for each session the date, speaker, topic, and chairperson.

The speakers could be graduate students or faculty members.

Graduate students are expected to present progress reports on their thesis or project research. The time allocated to a presentation should not exceed 30 minutes, the remaining time being left for discussion.

Attendance is mandatory. A student registered in the course is not allowed more than one unexcused absence.

The grade (P/F) is based solely on attendance. A single ‘F’ is cleared by a ‘P’ in the following semester. A student who accumulates two failures (F) will be dropped from the faculty.

**EECE 798  Special Topics**  
3 cr.  
The course may be given as a conventional course to a number of students on a topic that is not in the mainstream of faculty curricula but may arise due to a special interest on the part of a faculty member or a visiting faculty member. Grades in such a course will be reported in the usual numeric format, and the course designation will be EECE 798-Special Topics followed by an appropriate subtitle in brackets.

**EECE 799  Theses**

Every semester

**EECE 799T  Comprehensive Exam**  
0 cr.  
Every semester

**EECE 898  Advanced Topics in Electrical and Computer Engineering**  
3 cr.

**EECE 900  Qualifying Exam Part I: Comprehensive Exam**  
0 cr.  
Every semester
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<th>Course Code</th>
<th>Course Title</th>
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<th>Description</th>
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<tbody>
<tr>
<td>EECE 990</td>
<td>PhD Dissertation</td>
<td>0 cr.</td>
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<tr>
<td>EECE 991</td>
<td>PhD Dissertation</td>
<td>3 cr.</td>
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<tr>
<td>EECE 992</td>
<td>PhD Dissertation</td>
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<td>EECE 993</td>
<td>PhD Dissertation</td>
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<tr>
<td>EECE 998</td>
<td>Qualifying Exam Part II: Defense of Thesis Proposal</td>
<td>0 cr.</td>
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<tr>
<td>EECE 999</td>
<td>PhD Theses Defense</td>
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Notes
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<th>Event</th>
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<tr>
<td>Thu 15-Sep-11</td>
<td>Fall Term (11-12) advising and (Phase III) on-line course registration for current students in all Faculties except Medicine</td>
</tr>
<tr>
<td>Thu 15-Sep-11</td>
<td>Submission of applications for deferral of payment for the first semester for old returning, new students coming from abroad, new graduates, new Freshman students, special and transfer students. Application available on the web-site</td>
</tr>
<tr>
<td>Thu 15-Sep-11</td>
<td>Pre-registration for new students coming from abroad, new graduates and for new Freshman students, special and transfer students, Admissions Office, College Hall</td>
</tr>
<tr>
<td>Fri 16-Sep-11</td>
<td>International student orientation program, for all students coming from abroad, Office of International Programs.</td>
</tr>
<tr>
<td>Mon 19-Sep-11</td>
<td>Set registration holds for all new sophomore/first year students who did not submit their official documents</td>
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<tr>
<td>Mon 19-Sep-11</td>
<td>Orientation for all new Undergraduate Students (including Freshman, students coming from abroad, special and transfer students) and Graduate students.</td>
</tr>
<tr>
<td>Mon 19-Sep-11</td>
<td>Advising for New Graduates, new students coming from abroad, new graduates, new Freshman, old returning, and cross registering students special and transfer students,</td>
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<tr>
<td>Tue 20-Sep-11</td>
<td>Cancel registration for all current and new sophomore students who did not settle their fees</td>
</tr>
<tr>
<td>Wed 21-Sep-11</td>
<td>On-line course registration for new students coming from abroad, new graduates, new Freshman, old returning, cross registering students, special and transfer students,</td>
</tr>
<tr>
<td>Thu 22-Sep-11</td>
<td>Cancel registration for all new sophomore students who did not submit their official documents</td>
</tr>
<tr>
<td>Fri 23-Sep-11</td>
<td>Payment of fees for the first semester for new graduates, old returning, cross registering, new students coming from abroad, new Freshman students, special and transfer students</td>
</tr>
</tbody>
</table>

**Fall Term 2011 - 2012**

**Event**

<table>
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<tr>
<th>From</th>
<th>To</th>
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<tbody>
<tr>
<td>Mon 26-Sep-11</td>
<td>First semester begins for all Faculties except Medicine</td>
</tr>
<tr>
<td>Mon 26-Sep-11</td>
<td>Change of schedule for the first semester (Drop &amp; Add)</td>
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<tr>
<td>Wed 28-Sep-11</td>
<td>Late payment of fees for the first semester for new graduates, old returning, cross registering, new students coming from abroad, new Freshman students</td>
</tr>
<tr>
<td>Mon 5-Oct-11</td>
<td>Opening Ceremony</td>
</tr>
<tr>
<td>Fri 21-Oct-11</td>
<td>Deadline for submitting NSSF declaration for the academic year 2011-12</td>
</tr>
<tr>
<td>Sun 6-Nov-11</td>
<td>Mid-Ahda, holiday, No classes</td>
</tr>
<tr>
<td>Sun 6-Nov-11</td>
<td>Independence Day, holiday, No Classes</td>
</tr>
<tr>
<td>Sat 26-Nov-11</td>
<td>Hjra New Year, holiday, No classes</td>
</tr>
<tr>
<td>Mon 5-Dec-11</td>
<td>Ashoura, holiday, No classes</td>
</tr>
<tr>
<td>Tue 6-Dec-11</td>
<td>Founder's Day, Classes will be held</td>
</tr>
<tr>
<td>Tue 6-Dec-11</td>
<td>Second semester advising for current students</td>
</tr>
<tr>
<td>Wed 7-Dec-11</td>
<td>Last day for withdrawal from courses for the first semester</td>
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<tr>
<td>Wed 7-Dec-11</td>
<td>Inter-Faculty on-line transfer applications for the second semester 2011-12</td>
</tr>
<tr>
<td>Mon 12-Dec-11</td>
<td>Second semester on-line course registration for current students</td>
</tr>
<tr>
<td>Fri 23-Dec-11</td>
<td>Christmas and New Year vacation begins (10:00 pm)</td>
</tr>
<tr>
<td>Sun 1-Jan-12</td>
<td>Christmas and New Year vacation ends (10:00 pm)</td>
</tr>
<tr>
<td>Fri 6-Jan-12</td>
<td>Armenian Christmas, Holiday, No classes</td>
</tr>
<tr>
<td>Sat 14-Jan-12</td>
<td>10:00 p.m. Classes end for all Faculties except Medicine</td>
</tr>
<tr>
<td>Sun 15-Jan-12</td>
<td>Reading Period for the First Semester</td>
</tr>
<tr>
<td>Tue 17-Jan-12</td>
<td>Second semester advising for current students for the second semester</td>
</tr>
<tr>
<td>Thu 19-Jan-12</td>
<td>First semester examinations begin</td>
</tr>
<tr>
<td>Fri 24-Jan-12</td>
<td>Submission of applications for deferral of payment for the second semester for New &amp; Old returning. Application available on the web-site.</td>
</tr>
<tr>
<td>Tue 31-Jan-12</td>
<td>Second semester pre-registration for new, old returning and cross-registering students</td>
</tr>
<tr>
<td>Wed 1-Feb-12</td>
<td>First semester ends for all Faculties except Medicine</td>
</tr>
<tr>
<td>Sat 4-Feb-12</td>
<td>Prophet's Birthday, holiday, No classes</td>
</tr>
<tr>
<td>Mon 6-Feb-12</td>
<td>International student orientation program, for all students coming from abroad, Office of International Programs</td>
</tr>
<tr>
<td>Mon 6-Feb-12</td>
<td>New students orientation, Office of Student Affairs</td>
</tr>
<tr>
<td>Tue 7-Feb-12</td>
<td>Second semester advising &amp; on-line course registration for new, old returning and cross-registering students</td>
</tr>
<tr>
<td>Tue 7-Feb-12</td>
<td>Inter-Faculty on-line transfer applications for the Fall Term 2012-13</td>
</tr>
<tr>
<td>Thu 9-Feb-12</td>
<td>St. Maroun's Day, holiday, No classes</td>
</tr>
<tr>
<td>Fri 10-Feb-12</td>
<td>Late Payment for the second semester for all current registered students</td>
</tr>
</tbody>
</table>
### Spring Term 2011 – 2012

<table>
<thead>
<tr>
<th>FROM</th>
<th>TO</th>
<th>EVENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mon 13-Feb-12</td>
<td>Sat 18-Feb-12</td>
<td>Second semester begins for all Faculties except Medicine</td>
</tr>
<tr>
<td>Mon 13-Feb-12</td>
<td>Sat 25-Feb-12</td>
<td>Payment of fees for new students</td>
</tr>
<tr>
<td>Mon 13-Feb-12</td>
<td>Thu 16-Feb-12</td>
<td>Change of schedule for the second semester (Drop &amp; Add)</td>
</tr>
<tr>
<td>Mon 20-Feb-12</td>
<td>Sat 25-Feb-12</td>
<td>Late payment for the second semester for new and old returning students</td>
</tr>
<tr>
<td>Mon 5-Mar-12</td>
<td></td>
<td>Deadline for submitting NSSF Declaration for the second semester</td>
</tr>
<tr>
<td>Thu 5-Apr-12</td>
<td>Thu 5-Apr-12</td>
<td>10:00 p.m. Latin Easter vacation begins</td>
</tr>
<tr>
<td>Mon 9-Apr-12</td>
<td>Mon 9-Apr-12</td>
<td>10:00 p.m. Latin Easter vacation ends</td>
</tr>
<tr>
<td>Thu 12-Apr-12</td>
<td>Thu 12-Apr-12</td>
<td>10:00 p.m. Greek Orthodox Easter vacation begins</td>
</tr>
<tr>
<td>Mon 16-Apr-12</td>
<td>Mon 16-Apr-12</td>
<td>10:00 p.m. Greek Orthodox Easter vacation ends</td>
</tr>
<tr>
<td>Tue 24-Apr-12</td>
<td>Thu 3-May-12</td>
<td>Inter-Faculty on line transfer applications for the Summer Term 2012 for students applying to FAFS and OSB.</td>
</tr>
<tr>
<td>Fri 27-Apr-12</td>
<td></td>
<td>Last day for withdrawal from courses for the second semester</td>
</tr>
<tr>
<td>Mon 30-Apr-12</td>
<td>Thu 3-May-12</td>
<td>Advising and on-line registration for current students for the Summer 2012</td>
</tr>
<tr>
<td>Tue 1-May-12</td>
<td>Tue 1-May-12</td>
<td>Labor Day. No classes</td>
</tr>
<tr>
<td>Mon 14-May-12</td>
<td>Wed 16-May-12</td>
<td>Advising for current students for the Fall Term 2012-13</td>
</tr>
<tr>
<td>Mon 21-May-12</td>
<td>Thu 24-May-12</td>
<td>Fall Term (2012-13) early (Phase I) on-line course registration for current students in all Faculties except Medicine</td>
</tr>
<tr>
<td>Sat 26-May-12</td>
<td></td>
<td>10:00 p.m. Classes end for all Faculties except Medicine</td>
</tr>
<tr>
<td>Sat 26-May-12</td>
<td>Tue 29-May-12</td>
<td>Reading Period for the Second Semester</td>
</tr>
<tr>
<td>Wed 30-May-12</td>
<td></td>
<td>Second semester examinations begin</td>
</tr>
<tr>
<td>Thu 31-May-12</td>
<td></td>
<td>Classes end for Med. III and Med. IV</td>
</tr>
<tr>
<td>Mon 11-Jun-12</td>
<td>Thu 14-Jun-12</td>
<td>Pre-registration, advising and on-line course registration for new, old returning and cross registering students for the Summer 2012</td>
</tr>
<tr>
<td>Tue 12-Jun-12</td>
<td></td>
<td>Second semester ends for all Faculties except Medicine</td>
</tr>
<tr>
<td>Wed 13-Jun-12</td>
<td>Thu 21-Jun-12</td>
<td>Payment of fees for the Summer 2012</td>
</tr>
</tbody>
</table>

### Summer Term 2012

<table>
<thead>
<tr>
<th>FROM</th>
<th>TO</th>
<th>EVENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mon 18-Jun-12</td>
<td></td>
<td>Classes begin for Summer 2012 for all Faculties except Medicine</td>
</tr>
<tr>
<td>Mon 18-Jun-12</td>
<td>Thu 21-Jun-12</td>
<td>Change of schedule for the Summer Term (Drop &amp; Add)</td>
</tr>
<tr>
<td>Fri 22-Jun-12</td>
<td>Wed 27-Jun-12</td>
<td>Late Payment for the Summer 2012</td>
</tr>
<tr>
<td>Sat 23-Jun-12</td>
<td></td>
<td>Commencement Exercises</td>
</tr>
<tr>
<td>Thu 28-Jun-12</td>
<td></td>
<td>Classes end for Med. I</td>
</tr>
<tr>
<td>Mon 9-Jul-12</td>
<td>Tue 10-Jul-12</td>
<td>Fall Term (12-13) advising and early (Phase II) on-line course registration for current students in all Faculties except Medicine</td>
</tr>
<tr>
<td>Fri 20-Jul-12</td>
<td></td>
<td>Last day for withdrawal from courses for the Summer 2012</td>
</tr>
<tr>
<td>Sat 4-Aug-12</td>
<td></td>
<td>10:00 p.m. Classes end for all Faculties except Medicine, Agricultural &amp; Food Sciences, and Medical Laboratory Sciences</td>
</tr>
<tr>
<td>Mon 6-Aug-12</td>
<td>Sat 11-Aug-12</td>
<td>Final examinations for all Faculties except Medicine, Agricultural &amp; Food Sciences, and Medical Laboratory Sciences</td>
</tr>
<tr>
<td>Sat 11-Aug-12</td>
<td></td>
<td>10:00 p.m. Classes end for the Faculty of Agricultural &amp; Food Sciences, and Medical Laboratory Sciences</td>
</tr>
<tr>
<td>Mon 13-Aug-12</td>
<td>Sat 18-Aug-12</td>
<td>Final examinations for the Faculty of Agricultural &amp; Food Sciences, and Medical Laboratory Sciences</td>
</tr>
<tr>
<td>Wed 15-Aug-12</td>
<td>Wed 15-Aug-12</td>
<td>Assumption Day, holiday</td>
</tr>
</tbody>
</table>

Id al-Fitr, al-Adha, the Hijra New Year, Ashoura, and the Prophet's Birthday are determined after sighting the moon and because of that the actual dates may not coincide with the dates in this calendar. The holiday will be the first three days of the feast as declared for Id al-Fitr and for al-Adha, and the first teaching day for Hijra New Year, Ashoura and the Prophet's Birthday.