GRADUATE STUDY HANDBOOK

Ph.D. PROGRAM

THE
DEPARTMENT
OF
ELECTRICAL & SYSTEMS ENGINEERING

University of Pennsylvania

Academic Year 2010-2011

Revised 08/10
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I. INTRODUCTION

Welcome to the Electrical and Systems Engineering Graduate Group! The ESE Graduate Group offers various graduate education options. Students can pursue a Ph.D. degree in Electrical and Systems Engineering, a Master of Science in Engineering (MSE) in Electrical Engineering, or a MSE in Systems Engineering. Exceptional undergraduate students also have a chance to submatriculate to an MSE degree while pursuing their Bachelor of Science (B.S.) degree.

This handbook describes the most important rules and regulations regarding the PhD degree in Electrical & Systems Engineering and provides other useful information for graduate students. It is also designed to acquaint new students with the policies and procedures of the Electrical & Systems Engineering Graduate Group.

These rules and regulations apply to all PhD graduate students in the School of Engineering and Applied Science. Additional and most up-to-date information on the Electrical & Systems Graduate Group program, faculty and staff can be found on our web site http://www.seas.upenn.edu/ese.
**IMMEDIATE RESOURCES**

When you first enter the program, there are a few individuals who are important to know. These are:

**ADMINISTRATIVE COORDINATOR FOR GRADUATE PROGRAMS (Graduate Coordinator):**

**NICHOLE WOOD**
Office: 203 Moore Building. Telephone 215-898-9390 or woodn@seas.upenn.edu

The Administrative Coordinator is your primary contact person with the Electrical & Systems Engineering graduate programs. She will provide you detailed information about the graduate programs, registration, grades, policy and procedures as well as assist you with forms you may need to make changes or adjustments to your program.

**ACADEMIC ADVISOR:**

Your Academic Advisor will most likely be the faculty member supervising and sponsoring your PhD studies. Their role will change during the course of your graduate studies, but their primary duty will be to help you design your academic program of courses to meet your own research goals within the requirements of the graduate program.

**GRADUATE CHAIR:**

The Graduate Group Chair oversees the running of the Electrical & Systems Engineering program for both Masters and Ph.D.
II. Ph.D. IN ELECTRICAL & SYSTEMS ENGINEERING

GENERAL REQUIREMENTS
The successful completion of the Ph.D. program in ESE requires each student to complete at least 20 course units; (with approval, up to 9 courses can be transferred from a prior graduate program), to pass specific general examinations as required by one’s graduate group, and to write a dissertation conforming to the rules of Penn’s Doctoral Dissertation Manual. A 3.0 cumulative average must also be maintained as a PhD student. All doctoral work for full-time and part-time candidates, including the dissertation, must be completed within ten years from the student’s matriculation as a graduate student at Penn.

While the experienced and exceptionally prepared student may meet the course requirements by completing a minimum of 20 course units, graduate groups will in many cases require more extensive preparation through additional work. Of the 20 course units, no more than 6 can be research units (999), and no more than 3 can be independent study (899). Independent studies must included a detailed description of the material covered and the grading scheme used, and by approved by the Graduate Group Chair.

The successful completion of the Ph.D. program in ESE requires the satisfaction of the following requirements

1. Qualifying Examination
2. Course Structure Requirement
3. Teaching Practicum
4. Research Proposal Examination
5. Thesis Defense

The above requirements apply to all Ph.D. students in ESE that entered the program starting September 2002. We now describe each doctoral requirement.

1. Qualifying Examination

The qualifying examination is a written examination and consists of the following eight areas:

Qualifying Examination Areas
1. Linear Systems
2. Probability
3. Communications
4. Networking
5. Electromagnetics and Optical Fields
6. Solid State Electronics and Devices
7. VLSI and Microelectronics
8. Optimization

Each area corresponds to a written examination designed to evaluate the student’s understanding of the fundamentals in the area. The material for each exam area is precisely defined in the Qualifying Examination Syllabus, where sample textbooks and graduate courses per area are suggested. It should be noted that each exam area is related (though not fully) to the material typically covered in the graduate courses listed in the Qualifying Examination Syllabus. Students are advised to use the Qualifying
Examination Syllabus in preparing for the exam, and not rely solely on the material that was taught in a particular course. The department typically offers the suggested graduate courses on an annual basis.

The exam is offered during the last week of every May. In March, each student must declare 3 exam areas in which he or she will be examined in May of their first year in the PhD program. Students may be re-tested in the failed areas during a 2nd attempt, which will be in May of their 2nd year. If a student has not passed all three declared areas by the end of their 2nd year, the student will be required to leave the PhD program. If a student fails all 3 areas during the first attempt, the student may be asked to discontinue his/her PhD studies. Changes in the examined areas may be requested by petition to the Graduate Group Chair.

2. Course Structure Requirement
Doctoral students must complete a minimum of 20 course units including graduate level courses, independent study (899) courses, and research units. A minimum of eleven course units must be graduate level courses that are not research units. This includes no more than three independent study (899) units. The coursework is structured in order to emphasize both depth in the research area of the student as well as breadth in their education. The coursework of each Ph.D. student must be grouped in one major, two minors.

- **Depth Major**: At least five graduate level courses in areas supporting the research of the Ph.D. student.

- **Breadth Minor**: At least two graduate level courses, which are distinct from the major research area. The courses may be thematically linked in a 500-600 sequence, or may represent two 500 level courses, both distinct from the major research area. Independent studies cannot be used in this category.

- **Mathematics Requirement**: At least two graduate level courses satisfying formal mathematical reasoning. Courses that satisfy this requirement include graduate courses in Mathematics, Engineering Mathematics, Statistics, or Discrete Mathematics. Independent studies cannot be used in this category. **NOTE: ENM 503- Probability is not allowed to count towards this requirement. (Please see the section on Disallowed Courses- page 19). If you have questions on other math courses counting towards this requirement, please email the graduate chair.**

The remaining course units may be added to the above groups or may simply be grouped in a free electives category. The grouping of the courses will be outlined by the students in consultation with their advisors in a proposed Ph.D. Planning Guide. The Ph.D. Planning Guide will be updated every April throughout their Ph.D. career in order to reflect changes in courses, course offerings, and research focus. This will allow (every May) the Graduate Group to offer feedback to both the student and their advisor regarding Ph.D. requirements. The approval of the final Ph.D. course planning guide will be performed by the Committee of the Research Proposal Examination and the Graduate Group Chair.

3. Teaching Practicum
All Ph.D. students must complete a two-semester teaching practicum requirement by the end of their Ph.D. career. Teaching Practicum requirements begin during the second year of the PhD program, assisting with one course per semester. **First year PhD students will not be allowed to serve as TA’s.** It is expected that a student will spend approximately 15 hours per week on the teaching practicum. Great
effort will be made to have teaching practicum assignments in a manner that is consistent with the students' research and teaching interests and the teaching needs of the Department. It should be noted that the teaching practicum requirement must be completed by all Ph.D. students, independent of their funding support.

Training and Support for TA's: 1-day TA orientation plus optional Presentation Skills Workshop; international students must pass ELP SPEAK test. All prospective international teaching assistants (ITAs) who will teach undergraduates and whose native language is other than English must undergo an evaluation of their ability to communicate in spoken English before they can undertake teaching responsibilities. Two tests generally are used for this purpose: SPEAK (a score of 56 or above is necessary for certification); and IPT (Interactive Performance Test). The test is videotaped and is rated pass/fail. The department will cover the cost of the SPEAK and IPT tests. For additional information, please contact Joanna Ghosh (jghosh@seas.upenn.edu).

4. Provisional Doctoral Committee
All doctoral students are required to assemble a provisional doctoral committee at the end of their 2nd year.

The committee will consist of 2, possibly 3, “faculty” members in addition to the student's advisor. One of the faculty members will act as the chair of the committee and will need to be from ESE. The student’s advisor cannot act as the committee’s chair. Other committee members can be internal to ESE or external. It is suggested that having at least one of the committee members be from outside SEAS or Penn would be beneficial. Qualified industry researchers are eligible as external committee members. In addition to “faculty” committee members, a senior Ph.D. student will also be part of the committee to add a student’s perspective during the committee’s meetings.

The composition of the committee can be adjusted on a yearly basis, but only one faculty member can change each year in order to ensure adequate continuity. The committee is expected to eventually morph into the student’s thesis proposal committee, although this is not required. Given the intent of providing assistance and feedback to the student on his/her research and overall progress towards a Ph.D., it is expected although not required that the general research expertise of committee members will be at least loosely connected to the student’s research area.

Each PhD student is expected to make a yearly presentation to his/her provisional doctoral committee once it is formed. The first presentation should take place before the end of the third year. The presentation should describe the student’s research efforts over the past year, as well as his/her plans for the coming year. At the discretion of the student and his/her advisor, the presentations may be open to the public, or the audience limited to committee members. The committee is expected to provide feedback regarding the student’s progress or lack thereof towards a successful thesis, and offer advice of both technical and logistical natures aimed at improving the student’s chances of success. The committee’s assessment will be documented in a short report by the committee chair in collaboration with the student’s advisor and other committee members. The student will be provided with a copy of the report and another copy will be kept on record in the ESE office.

While the yearly presentation serves as an official forum for the committee to provide feedback to the student, the expectations are that interactions between the student and members of his/her committee will not be limited to this yearly event. In particular, faculty committee members commit to being available to meet with the student on a regular basis and upon request. Fostering such interactions is one of the main motivations for the provisional doctoral committee. Such regular exchanges are key to
offering our Ph.D. students the opportunity of a richer educational experience, as well as the ability to develop broader contacts that may prove useful upon starting their professional life, e.g., because of their longer term exposure to the student’s work, committee members would be in a better position to both advertise the student’s work outside Penn as well as write better recommendation letters when requested to do so.

The committee's recommendations are only advisory in nature. The student’s advisor remains the sole judge of whether or not the student is making adequate progress in his/her research. Remedial actions, if any, will be implemented at the decision of the student's advisor and under his or her control. This will change if and when the provisional doctoral committee morphs into the student’s proposal committee and ultimately thesis committee, at which point these committees will assume their standard prerogatives.

5. Research Proposal Examination

All Ph.D. students must pass the Research Proposal Examination (Proposal Defense). This exam is administered by the Research Proposal Committee, which consists of four members, including the Committee Chair. The Committee must be proposed to and approved by the Graduate Chair. The research advisor of the student, who is part of the committee, cannot serve as the Chair of the Committee.

The recommended time for the Research Proposal exam is the third year of study. Prior to the exam, the students must submit a 3-page proposal to the Committee which provides a high level description of the nature of research, goals and impact of the proposed research, related work, existing results, references, and course plan of attack. It is highly recommended that the proposal document should be delivered to the committee at least two weeks in advance of the defense, to allow time for thorough reading. The students must also submit to the Committee the most current version of their Course Planning Guide (CPG) (obtained from the Graduate Coordinator).

The examination consists of a 45-minute oral presentation where the student must provide evidence to the committee that there is a research problem that needs to be addressed, and that the student is capable of addressing the problem. The Committee must assess the research quality, potential, and ability of the student to perform research. In addition, the Committee reviews and approves the most current version of the student’s Course Planning Guide (CPG). The outcome of the Research Proposal Examination is

1. **Pass:** Research Proposal Examination requirement completed.
2. **Fail:** In rare circumstances, the student may fail the exam & may be asked to retake it.
3. **Defer:** Based on the student’s performance and Course Planning Guide, the Committee may make personalized recommendations. If necessary, the Committee may request reexamining the student after the student implements specific suggestions provided by the committee.

**IMPORTANT NOTE:** Once the student has scheduled the Examination (Proposal Defense) please forward the information via email to the Graduate Coordinator. A Report of PhD Proposal Defense form will need to be picked up one day prior to the date of the examination.

6. Thesis Defense

The thesis defense examination is administered by Thesis Defense Committee that consists of three members in addition to the research advisor of the student. One member must be outside the ESE
Graduate Group. The Committee must be proposed to and approved by the Graduate Chair. The research advisor of the student cannot serve as the Chair of the Committee.

The dissertation should be delivered to the committee at least two weeks in advance of the defense, to allow time for thorough reading.

**IMPORTANT NOTE:** Once a student has scheduled the defense and reserved a room, please forward via email an announcement to the Graduate Coordinator for posting to the appropriate graduate and faculty email lists. Announcements should include name, dissertation title, a brief abstract, committee members, chair and advisor, day, time and place of defense. Dissertation Defense forms will need to be picked up one day prior to the date of the defense.

Every Ph.D. student must write a dissertation conforming to the rules of Penn's Doctoral Dissertation Manual*. The doctoral dissertation will be evaluated and approved (by majority vote) by the Thesis Defense Committee.

*A copy of the Manual can be obtained by accessing the following website: [http://www.upenn.edu/grad/DissManual.html](http://www.upenn.edu/grad/DissManual.html). The office is located in 3401 Walnut Street, Suite 322A.*
6. Qualifying Examination Syllabi

A) Linear Systems

1. State space and input-output descriptions of systems. Continuous-time and discrete time systems. Differential and difference equation models.

2. Linear spaces, subspaces, bases, change of basis, inner products, norms, projections, orthonormalization.

3. Linear operators, matrix representation, adjoint operators, generalized solutions to linear equations, least squares minimization.


5. Explicit solutions to linear differential equations, linear control systems, state transition matrix, properties of state transition matrix, sampled data systems.


7. Controllability, observability of linear systems, controllability criteria, observability criteria, duality, Kalman decomposition.


9. State feedback, pole placement, stabilizability, state observation, full and reduced observers, detectability, separation of observation and control.

Representative Texts:


Recommended Course: ESE 500
B) Probability and Random Processes

Discrete and continuous probability spaces; combinatorial probabilities; conditional probability and independence; Bayes rule and the theorem of total probability; random variables and vectors; distribution functions, probability density functions, and probability mass functions; independent random variables; Borel’s normal law; measures of central tendency --- mean, median, mode; mathematical expectation; moments; moment generating functions and characteristic functions; tail inequalities --- Markov, Chebyshev, Chernoff; limit theorems; random processes; Gaussian and Poisson processes; stationarity and ergodicity; correlation functions; spectral densities; filtered random processes; bandlimited processes and the sampling theorem.

Representative Texts:


Recommended Course: ESE 530
C) Communications


2. Sampling and reconstruction of bandlimited processes. A/D and D/A conversion.

3. Elements of information theory. Entropy, source coding, variable length codes, Huffman coding. Mutual information and channel capacity. Capacity of simple discrete channels and of additive white Gaussian noise (AWGN) bandlimited channels. Channel coding, basic principles of block and convolutional codes.


5. Bandlimited channels and inter-symbol interference, Nyquist pulse shaping criterion, pulse design, error probability of PAM systems. Adaptive equalization.

References:


Recommended Course: ESE 576
D) Networking

*Packet and Bit Levels:* Framing, Bit errors - detection and correction, Coding based schemes, Retransmission based schemes, Basic Tools, Elementary queueing theory, Discrete time and continuous time Markov Chains, Fluid-Flow source models, Applying the Tools, Point-to-point Links.

*Delay and loss models:* Shared Links, Modeling and analysis, Multiple access systems, Switching systems, Fluid models for packetized voice, Routing in Packet Networks, Shortest Path algorithms, Optimal routing and route optimization.

**Representative Texts:**


**Recommended Course:** TCOM 501.
E) Electromagnetics & Optical Fields

Electrostatics and magnetostatics: Coulomb's law, Gauss' law, polarization, energy, forces from electric fields, Poisson's and Laplace's equation, boundary-value problems, special methods (e.g., image theory, Green's functions, spherical harmonics, multipole expansions), capacitance, dielectrics, current, resistance and conductance, magnetic flux density, Biot-Savart law, Ampere's law, vector potential, magnetic materials, magnetization, boundary conditions, ferromagnetic materials.

Faraday's Induction Law and Maxwell's Equations: Faraday's and Lenz's laws, transformer, flux linkage and inductance, forces from magnetic fields, Lorentz force law, displacement current, wave and Helmholtz equations, equations for potentials, retarded potentials, time-varying Green's functions, energy in fields, Poynting vector, wave polarization, Stokes parameters, skin effect.

Electromagnetic Materials: Dielectrics, dielectric function and refractive index, dispersion, magnetic materials, material losses, anisotropic materials.

Plane Waves and Propagation: Plane wave propagation, attenuation, reflection and refraction at interfaces, critical angle/total internal reflection, polarizing angle, reflection from and transmission through layered media, approximation methods (e.g., Born approximation).

Guided Waves and Cavities: Transmission lines, TEM propagation, rectangular metallic waveguides, TE and TM waves, circular metallic waveguides, dielectric slab waveguides, and metallic cavities.

Radiation and Scattering: Electric and magnetic dipoles, multipole radiation, near fields and far fields, radiation impedance, antenna gain and directivity, linear antennas, antenna arrays, sidelobes, scattering from cylinders and spheres, long-wavelength (Rayleigh) scattering, high-frequency and geometrical-optical scattering.

Mathematical Methods: Vector calculus, ordinary and partial differential equations, Green's functions, Sturm-Liouville theory and orthogonal function expansions, special functions, complex variables (e.g., functions of a complex variable, contour integration), use of transform techniques, approximation methods.

Representative Texts:


Recommended Course: ESE 510
F) Solid State Physics and Devices

Crystal Properties and Growth of Semiconductors: real space lattice, crystal structures, bravais lattices, lattice planes, miller indices, reciprocal space, brillouin zones, bulk crystal growth, epitaxial growth. Frenkel and Shottky defects, equilibrium statistics of point defects, edge and screw dislocations, Burgers vector.

Quantum Phenomena: general Schrodinger’s equation, uncertainty principle, pauli’s exclusion principle, elementary statistics, distribution functions, particle in the potential well, tunneling.

Energy Bands and Charge Carriers: bonding forces in solids, energy bands, free-electron approximation, energy bands, electron and holes, effective masses, Fermi level, Fermi statistics, conductivity, mobility, drift, Hall effect

Optical Properties: carrier generation, carrier diffusion, direct and indirect recombination processes, carrier lifetimes, diffusion length. Spontaneous recombination, stimulated emission, absorption and gain,

Junctions: PN homojunction, equilibrium conditions, quasi-Fermi levels, forward and reverse biased junction, breakdown, AC models, Schottky Barriers, ohmic contacts, heterojunctions

Basic Transistor Devices: junction FET, MOSFET, BJT and related operation, transistor operation, biasing, amplification

Optoelectronic Devices: Photodiodes, LEDs, semiconductor lasers

High-Frequency Devices: Tunnel diodes, IMPATT diodes, Gunn diodes, MESFET, MODFET

Quantum Effect Devices: low-dimensional density of states, coulomb blockade, single electron transistors

Representative Texts:

3. Introduction to Solid State Physics, C. Kittel, Wiley, 1986, chapters 1, 2, 6 to 11, 18, and 20.

Recommended Course: ESE 521
G) VLSI & Microelectronics

The MOS Capacitor: Electric fields, potential distribution, work-function difference, oxide and interface state charge, threshold voltage.

MOSFET Structure and operation: IN characteristics (gradual channel approximation), enhancement and depletion mode transistors, back-gate effect, mobility variations and other second order effects.

Small Geometry MOSFETS for VLSI. Scaling Theory, limitations to scaling, short-channel and narrow-width effects, sub threshold region, drain punch through, impact ionization (hot electrons).

DC and Switching Characteristics of MOS Inverters: Different types of inverters noise margins, DC power dissipation, Rise and fall times, delay times, power-delay product, and MOSFET capacitances.

Basic steps of MOS Integrated Circuit Fabrication: Basic understanding of the technological steps (oxidation, deposition, lithography and etching), isolation techniques, masks layers, NMOS and CMOS process flow.

MOS Logic Circuits: NMOS and CMOS logic gates: device optimization and design issues, transmission gate logic, dynamic MOS logic, structured MOS logic structures.

Analog building blocks: current mirrors, elementary transitory circuits, simple operational amplifiers, feedback and applications of op operational amplifiers (i.e. simple circuits using op amp building blocks).

Representative Texts:


Recommended Course: ESE 560
H) Optimization

This area deals with the mathematical theory of linear and nonlinear optimization. Topics covered include

- Linear programming, Simplex method, duality theory.
- Transportation and Network flow problems.
- Integer Programming (branch and bound techniques), Mixed IntegerLinear Programming (MILP).
- Nonlinear programming, Karush Kuhn Tucker conditions.
- A brief overview of interior point methods and global optimization techniques.

Suggested Texts:

1. *Introduction to Mathematical Programming*, by Frederick S. Hillier and Gerald J. Lieberman

Recommended Course: ESE 504
III. GENERAL INFORMATION

Full-Time Status
Doctoral students are considered to be full time students if they are registered for three course units in the fall and spring semesters.

Residency Requirement
Twelve course units must be completed at the University of Pennsylvania. Every Ph.D. student must spend at least one year in residence at the University of Pennsylvania (which means two consecutive semesters of full-time status while being at the University of Pennsylvania, exclusive of summer courses).

Minimum grade point average
A 3.0 cumulative average must be maintained as a PhD student.

Time Limit
All doctoral work for full-time and part-time candidates, including the dissertation, must be completed within ten years from the student's matriculation as a graduate student at Penn.

Transfer of Credit- UPDATED
Ph.D. candidates are permitted to transfer up to nine courses from other programs. Transfer of credit must be approved by the faculty teaching the equivalent SEAS course, the Graduate Group Chair and Associate Dean for Academic Affairs. Courses counted towards an undergraduate degree will not be considered for graduate credit unless in an approved submatriculation program.

Registration
Directions and procedures for registering using the PennInTouch registration system are available from https://sentry.isc.upenn.edu/intouch.

IMPORTANT NOTE: During the registration period each semester, all ESE graduate students are placed on an administrative “hold” to insure that students consult with their advisors before registering for classes. Before you can register using PennInTouch, the hold must be cleared, either by submitting the Faculty Advisor Sign-Off Form signed by both student and advisor or by an email from the advisor to the Graduate Coordinator. Once the “hold” is released, student can register; add/drop courses, etc. using PennInTouch.

995 Registration- UPDATED
Students who have completed five years of full-time status are eligible for 995 courses, which allow full-time status with reduced tuition fees. To be eligible to register for 995, a student must have completed the equivalent of five years of full-time study (3 course units each semester). If he or she came to Penn Engineering with a Master’s degree, up to nine of those credits can be transferred to the Ph.D. program upon the approval of the Graduate Group Chair. A student may take 995, which also carries full-time status with 0 credit units, up to eight semesters. Twenty course units satisfy the degree requirement but not the 995 registration requirement.
Disallowed Courses for Graduate Students
The following types of courses may not be taken to satisfy requirements for a SEAS graduate degree:
1) Undergraduate level courses
2) Any course from the following programs at Penn:
   a. Wharton Evening (these are actually undergraduate level)
   b. Wharton Certificate Program for Working Professionals (usually 4XX numbered courses. These are actually the same courses as Wharton Evening)
   c. Organizational Dynamics (a SAS offered master's level program)

Addition
3) ENM 503- Introduction to Probability and Statistics- this course may not be used for credit toward the 20 unit requirement for a PhD degree. With the approval of the advisor, it may count toward the ten units required for a master’s degree. (Note: This course is not suitable to prepare students for the qualifying exam in Probability).

Retaking a Course
No course may be retaken/re-registered to improve a grade of "C" unless the content is different. (Students may, with instructor’s permission, do additional work to improve this grade). Graduation may not be postponed for grade improvement if all other graduation criteria are met.

Low grade Received in Required Course(s)
If a grade of D or F is received in a required course, which prevents graduation, the student has three options:
(1) At the discretion of the instructor, the student can work with the instructor to improve the grade to C or higher with additional course work.
(2) At the discretion of the instructor, the student can retake the course by attending the course again (in a subsequent term) without registering or paying additional tuition, and will receive a grade change if earned.
(3) If instructor does not agree to either (1) or (2), the student's only option is to register and pay tuition for the course again. Upon successful completion of the retake, the original registration will be changed to “withdraw”. [Thus the original course CU and grade will not be counted toward graduation CUs or GPA; i.e., SEAS will not allow the course to be counted twice toward the degree.]

Graduation Checklist
Students planning to graduate must register for graduation on or before the deadline set by the SEAS Graduate Office. Forms are available online: http://www.seas.upenn.edu/forms, or in the Graduate Office, room 111 Towne Building. There is a $25.00 late charge fee.
• Make sure your bursar bill is cleared before the end of the final semester. Any outstanding balance will prevent you from receiving your diploma. A large outstanding balance might prevent you from graduating.
• Check that your academic record is clear of all F’s, Incompletes, No Grade Reported, and Unsatisfactory Progress (any of which will prevent you from graduating), that your cumulative GPA is at least 3.0, and that you have taken the appropriate courses for the Ph.D. degree.
• If you have completed all degree requirements (including the defense of your dissertation) before your last semester, and you need only to submit your dissertation, you may be eligible to be exempted from tuition payments for the last semester. See the Graduate Coordinator to get the form for this exemption.
• Dissertation Submission- All PhD candidates are governed by procedures established in the School of Arts & Sciences Graduate Office, 3401 Walnut, Suite 32A, and dissertations are
submitted there. It is necessary to schedule an appointment (by calling 898-7444) to submit the dissertation.

**REQUIREMENT:** Three forms must accompany the dissertation. One of these forms certifies that the student has met all PhD requirements, and it is signed by the dissertation advisor, the Graduate Group Chair, and the Associate Dean. The “153” form certifies that the dissertation is ready for microfilming, and it is signed by the Graduate Group Chair only. An “Acceptance of Dissertation” form, signed by your advisor, dissertation committee members, and the graduate group chair must also be submitted with your dissertation - contact the Graduate Coordinator regarding these forms & needed signatures.

**Leave of Absence/Withdrawal**
In the case of a student needing to take a leave of absence or withdrawal from the School of Engineering and Applied Science, a Petition for Action form must be completed and signed by the faculty advisor, graduate chair and associate dean. Reinstatement is dependent upon departmental and SEAS approval.

**Student Health**
The University requires all full-time students to have health insurance. Students must provide information about their insurance coverage each year. All students must submit either a *waiver* or an *enrollment form* to the Student Health Insurance Office. Please visit the Student Health Insurance web site at [http://www.upenn.edu/shs/insform.html](http://www.upenn.edu/shs/insform.html). The Student Health office will place a hold on your registration if you do not submit any one of the documents mentioned above.

**Monthly Stipends (Paycheck)**
Students who are funded by their sponsoring faculty will receive a monthly stipend also known as “a monthly paycheck”. Checks are issued on the last working day of each month, with the exception of the month of December, when the checks are issued early in order to observe the Christmas Holiday vacation. You may pick up your check in room 203 Moore anytime between 9am-5pm daily. Please bring your student picture ID.

**Office Space/Keys**
Office space is provided for all full-time Ph.D. students. A refundable key deposit of $10.00 is required. See the Graduate Coordinator for more details.

**Student Mail Boxes**
Full-time and part-time PhD students are assigned mail boxes. PhD’s mail boxes are located inside room 203 Moore (the main ESE Office). This mail box is used for official university and department correspondence only. Please do not use the department office address for your personal mail.

**Student Identification Cards**
New students must obtain a photo ID card upon arrival on campus. The PENNcard Center is located at 3451 Walnut Street, The Franklin Building, room 150, 1st floor, phone # 215-417-2273 ([http://www.upenn.edu/penncard](http://www.upenn.edu/penncard) or E-mail: penncard@pobox.upenn.edu). The Center is open daily, call to check office hours. These cards are required by the University libraries, residences and recreational facilities, etc.

*Graduate Forms can be found online at:* [http://www.seas.upenn.edu/forms](http://www.seas.upenn.edu/forms)
For more information pertaining to SEAS graduate students please review the Penn Engineering Graduate Student Handbook at: [http://www.seas.upenn.edu/grad/handbook/](http://www.seas.upenn.edu/grad/handbook/)