

INFORMATION FOR PhD STUDENTS

IN ENGINEERING SCIENCES AND APPLIED MATHEMATICS 2012-2013

September 1, 2012

Dear Graduate Students,

This booklet is prepared to aid you in your educational and research endeavors. Please read it carefully and be aware of the requirements and responsibilities described. The information supplied herein is more specific than that in the *Graduate School Bulletin*. You should also familiarize yourself with the general regulations of The Graduate School.

Please feel free to come in to see me if you have any questions, problems, or points of concern.

Vladimir Volpert, Professor and Chair

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INFORMATION FOR GRADUATE STUDENTS

Welcome to the Engineering Sciences and Applied Mathematics Department. Please keep and refer to this booklet throughout your years as a graduate student. Every effort has been made to anticipate your questions-on adviser selection through final checkout. You are responsible for knowing this material!

I. FIRST YEAR ADVISER

During New Student Week, you will meet with your first-year adviser who will assist you in selecting courses for your first quarter of study. The first-year adviser will continue to be your course adviser through the first year of the program until you choose your research adviser at the end of the first year.

II. PhD DEGREE IN ENGINEERING SCIENCES AND APPLIED MATHEMATICS

A. Residency and Course Load

The minimum residence requirement for the PhD degree is eight consecutive quarters, including summer, at Northwestern. **Course and 590 (research) units should total to 3-4 units each quarter to maintain full-time status.**

B. Research

Graduate study should be considered full-time employment. Annual academic progress reports must also be submitted by the student in June of each year following the first year.

C. Course Requirements

1. Students Entering with BS Degree

Students entering with a BS Degree must take at least twenty graded academic courses. P/N grades are not allowed. Full-time students are required to take twelve academic courses during their first three quarters (excluding the summer quarter) of graduate study at Northwestern. Enrollment in the core curriculum is mandatory. In addition to the twelve core courses, five additional 400 level ESAM courses (excluding 499), or 400 level courses in other departments that are taught by ESAM or courtesy faculty, are required. According to University policy, students must maintain a 3.00 average to receive financial assistance.

GPA's are calculated according to the following scale: A = 4, A- = 3.7, B+ = 3.3, B = 3, B- = 2.7, C+ = 2.3, C = 2 and will appear on graduate student transcripts.

a) Core Courses in Engineering Sciences and Applied Mathematics

The following four courses comprise eight units of the graduate core curriculum in engineering sciences and applied mathematics and are to be taken in sequence by all students in their first three quarters (excluding summer) of graduate study.

ES_APPM 411-1,2,3 Differential Equations of Mathematical Physics (3 units)

ES_APPM 420-1,2 Asymptotic and Perturbation Methods in Applied Mathematics (2 units)

ES_APPM 421-1 Models in Applied Mathematics (1 unit)

ES_APPM 446-1,2 Numerical Solution of Partial Differential Equations (2 units)

Waiving Core Courses:

Students who are sufficiently prepared in the subject matter of a core course may submit a waiver form signed by the first-year adviser and approved by the Chair. The instructors may require documentation, e.g. text used, course outline, lecture notes, exams, etc. The signed form should be given to Beth Siculan to be placed in the student's file. Please note that the waiving of a course does not decrease the total number of courses required.

b) Elective Courses

The remainder of the twelve courses for the PhD are to be selected by the student in consultation with his or her adviser. Up to three of the elective courses can be in any department in engineering, mathematics or the physical sciences provided they are listed in the *Graduate School Policy, Program, and Course Catalog* (http://www.tgs.northwestern.edu/documents/academic-services/TGS%20Policy%20Guide%202011_2012.pdf), with the remainder of the courses taken within the ESAM department. Additional electives outside the ESAM department can be requested and are subject to approval by the Department Chair. Any courses taken for the PhD must be an extension of the student's background rather than a repetition of work done as an undergraduate.

c) Responsible Conduct of Research

Responsible Conduct of Research (RCR) training is required by the Graduate School of all first year graduate students and consists of two parts. The first part is a 3-hour ES_APPM 519 seminar. Information about RCR can be found at http://www.esam.northwestern.edu/docs/RCR_Training_Memo.pdf. The second is a CITI online course that must be taken before the beginning of the second year of studies. Information on setting up a CITI account can be found at http://www.esam.northwestern.edu/docs/setting_CITI_account.pdf.

2. Students Entering with MS Degree

Students entering with a MS Degree must take at least eighteen graded academic courses. All other requirements in III.C.1, i.e. the eight core courses, must be satisfied.

Permission to count courses taken during MS study against the eight core courses may be granted by the Department Chair. Approval may require documentation, e.g. text used, course outline, lecture notes, exams, etc. If an exemption is granted, a signed waiver form should be returned to Beth Siculan to be placed in the student's file. Please note that waived courses do not decrease the total number of courses required.

D. Teaching Requirement

All students in the PhD program are required to serve in some instructional capacity for at least one academic quarter. This may include, but is not limited to, serving as a teaching assistant or a grader. Most students complete their teaching requirement during the second year of studies.

E. The Preliminary Examinations

Within the first two weeks of the Winter quarter of the first year of study, students will be given four preliminary examinations on the topics of advanced calculus, differential equations, linear algebra, and complex variables. These Preliminary Examinations will be on advanced undergraduate material. Sample examinations from previous years as well as a list of textbooks that cover the topics will be e-mailed to each entering PhD student before the start of Fall quarter. The exams will be given as four separate 2-hour exams scheduled so that they do not conflict with the students' courses.

Students who fail one or more exams will be given an opportunity to retake a new exam on the same subject(s)

within the first two weeks of the Spring quarter of the first year. To remain in good academic standing in the PhD program and to continue into the second year of study, students are required to pass all four preliminary examinations. Students who are unable to pass all four exams, but otherwise satisfy all the requirements for an MS degree, will be awarded an MS degree.

F. Permanent Advisers

1. The Selection Process

In the spring of the first year of the program, students in good academic standing need to identify a permanent research adviser. This identification process begins with faculty giving presentations on their research in a series of half-hour sessions. The sessions will include information about the technical work to be completed as well as the options for financial support. Students interested in presented topics are *strongly* encouraged to contact the faculty individually to discuss further details about the project. Students should talk with every faculty member whose project is of interest and if appropriate, request to join the faculty's research group. Once a faculty member and student agree to work together, the faculty member becomes the student's permanent adviser for the remainder of the PhD program as long as progress remains satisfactory.

Before the last day of class in the spring quarter, all first-year students in the PhD program must submit to the chair their choice for adviser. Failure to obtain a research adviser by that date will remove the student from good standing and continuation in the program will be at risk. It is the student's responsibility to find a research adviser. Students having difficulty should contact their first year adviser and/or the department chair for guidance.

It is hoped that this processes will provide each student with an adviser who will satisfy the student's research interests. Faculty members in the Department conduct research over a wide spectrum of areas. Please be aware, however, that availability of any particular project is subject to the availability of funds to support that research.

In rare instances, a change of adviser may be necessary due to loss of funding or for other reasons. The Department Chair handles such changes on an individual basis.

2. The Faculty Adviser's Role

The permanent adviser will provide advice concerning your graduate studies and **must** be consulted about course selection. The adviser may, especially in the early stages of your graduate career, provide fairly close direction of your thesis research. The adviser will also serve as chairman of the faculty committee that conducts your qualifying examination and your thesis defense.

Responsibility for meeting published deadlines and degree requirements rests with the student. The Northwestern University Academic Calendar is available at <http://www.registrar.northwestern.edu/calendars/index.html>. The Graduate School deadlines and requirements can be found on their website at <http://www.tgs.northwestern.edu/academics/academicservices/phd/index.html>.

G. The Qualifying Examination

1. Time Requirements:

Students must take the Qualifying Examination by the end of the twelfth quarter (including summers). Students are encouraged to take the examination earlier, if possible. Exceptions for extenuating circumstances must be made by petition to the Chair and signed by the student's adviser.

2. Qualifying Examination Procedure and Committee Makeup

The examination will be wholly or partially oral and may cover courses taken both in and out of the Department, though emphasis is normally on the core required courses taken during the first year. The exam will be conducted by a committee consisting of at least three faculty members of the Department. At least two committee members, including the committee chair, must be listed as members of the graduate faculty of the University. Faculty members with courtesy appointments can be considered as either internal or external members of the committee, provided that the committee has at least two core ESAM faculty members.

Students should:

- a) Personally contact each member of the committee asking if each is willing to serve and to find a date and hour satisfactory to each one. Reserve a conference room for at least 3 hours.
- b) Fill and submit the TGS Prospectus Form on Caesar.

3. Outcome of the Qualifying Examination

One of three possible outcomes will result from the qualifying examination:

- 1) Pass: The student is now recognized by the Graduate School as a candidate for the Ph.D. degree.
- 2) Fail with option to retake: The Qualifying Examination Committee determines the student has not performed satisfactorily on the exam, but well enough to have an opportunity to retake the Qualifying Examination at a later date. The retaken Qualifying Examination must still be passed by the end of the twelfth quarter in order for the student to continue in the PhD program.
- 3) Fail: The student cannot work directly toward the Ph.D. degree. A student who fails the Qualifying Exam may consult with his/her adviser and the Department Chair to determine the best course of action following this result.

Students failing to pass the Qualifying Examination within the time limits outlined above are generally not eligible to receive financial aid from University sources (Research Assistantships, Fellowships, and Teaching Assistantships).

The Graduate School does not recognize a candidate for the PhD degree until the Qualifying Examination is passed.

H. Annual Reviews

The Graduate School requires programs to conduct annual academic reviews of all students in the program. The preliminary exam serves in this capacity for the first year students. In subsequent years, the student will prepare a one-page annual report of academic progress to be submitted in June. This report will be reviewed by the thesis adviser and chair and feedback provided as necessary.

I. The Thesis Defense/Final Examination

Each PhD candidate must successfully pass a Final Examination based principally on work presented in the dissertation. A faculty committee consisting of at least three faculty members conducts the examination. At least two committee members must be from the faculty of ESAM and at least two committee members of the

graduate school including the chair. This examination involves a mandatory open and publicized oral presentation and discussion during the first hour followed by a closed examination with only the committee.

Procedures:

Students should

- a) Choose faculty committee members and request their participation.
- b) Contact committee members to set date and time.
- c) Receive the adviser's approval that the dissertation is in final form and ready to be presented to the committee for review. ("Final form" means fully proofread. Faculty members should not be expected to serve as proofreaders.)
- d) Reserve a conference room. Contact the Department office staff to reserve a room and so that a public notice of the presentation can be posted. Supply names of committee members for submission to the Graduate School **at least three weeks** before the exam. Enter information regarding committee members, date and title of thesis on the Caesar website under PhD Final Defense.
- e) Note that the deadline for taking the exam and submitting the dissertation to the Graduate School varies each quarter. Consult the timetable on the Graduate School website for exact dates each year.
- f) Be reminded that the format of the dissertation must conform to standards established by The Graduate School and available on their website at http://www.tgs.northwestern.edu/documents/academic-services/guidelines_for_students.pdf.
- g) Present each examining committee member with a copy of the dissertation **at least two weeks** before the examination.
- h) After final approval, turn in one unbound copy of the dissertation to the Department office to be bound (at department expense) for the ESAM collection. (Additional copies may be given to the office to be bound at the student's expense.) Also furnish the Department with a copy of the abstract, and the Certificate of Careful Editing, signed by the student and adviser.
- i) Provide the Department with a 1-2 paragraph summary of your dissertation in a form that is written for a general audience, and could be posted on the department website.
- j) Before final departure, complete the sign-out sheet, return borrowed items (theses, library books, etc.), and be sure to leave a forwarding address with the Engineering Sciences and Applied Mathematics Department office. Upon return of all keys, the key deposit will be returned.

J. Academic Standing

The Graduate School details procedures for determining Good Academic Standing, Probation, and Exclusion. See the Graduate School website at

<http://www.tgs.northwestern.edu/academics/academic-services/satisfactory/index.html> for details.

III. GENERAL INFORMATION

A. Stipend Checks

All recipients of Research Assistantships or Fellowships must complete Employment Eligibility (I9) forms, the Federal W-4 and IL W-4 forms for the University. International students must also complete the Alien Tax Status and other forms required by the Federal government. These forms are now on the web and the Human Resource Department will assist you. **The I-9 form must be completed electronically by the start of classes in the Fall quarter** (see <http://www.tgs.northwestern.edu/financialaid/payrolleverify/>). In addition, the department will need a copy of your completed Personal Data Form.

All checks must be direct deposit, hard copies are not available. To view check, please use the HRIS Self Service website. **Please note: To avoid financial problems at the beginning of Fall Quarter, all incoming students should be aware that you will not receive your first check until September 30th.**

External Fellows: In order to process supplements and stipends, we *must* have copies of your original award letter and any renewal/adjustment letters in subsequent years.

Avoiding late fees: Tuition bills are online. If anything other than tuition is owed, the bill will be passed on immediately to the student for payment. If you have any questions regarding your tuition bill, see the ESAM office staff.

B. Research Registration

Doctoral candidates should enroll in ES_APPM 590 Research plus the required courses for the first eight quarters to ensure full-time registration and fulfill the residency requirement. After the residency requirement is fulfilled TGS 500 is used in place of ES_APPM 590 for the duration of the program. **Note: Summer registration is mandatory for all students on university support or on F1 or J1 visas.**

C. Pass/No-Credit Option

Students working toward an MS or a PhD in Engineering Sciences and Applied Mathematics may **not** use courses taken on a P/N basis to satisfy course requirements. Graduate students may, with the approval of their adviser, take courses on a P/N basis *after* satisfying the departmental course requirements.

D. Academic Honesty

Students are strongly advised that originality is essential in all homework, projects, exams, theses, etc. associated with graduate work. Students are required to do their own work. Ideas, data, or word-for-word quotations taken from other sources (*including the work of fellow students and other group members*) must be appropriately referenced; otherwise plagiarism will have been committed. The following statements should help define what is meant by "appropriately referenced":

a. All ideas, data, mathematical expressions, and word quotes taken from the works of others should be clearly and directly referenced to the original author. This is best accomplished by listing a reference number after the material with the numbered references appearing at the end of the manuscript. The following format is also acceptable:

"The equation can be derived following the approach of Jones³³ as follows:..."

b. Word for word quotes **must** have quotation marks at the beginning and end and be referenced

in the manner described above.

- c. Photocopied figures should be referenced as described in a. above.
- d. Redrawn figures or plots made from other people's table of data can be appropriately labeled "after Smith⁴³".
- e. Each person should receive proper recognition for contributions made.

Special note: group collaboration on homework assignments is at the discretion of the professor. Unless otherwise stated, students are expected to turn in their own original work.

In accordance with Graduate School regulations, "All cases of alleged academic dishonesty involving students of The Graduate School are to be referred by members of the faculty to the Dean of The Graduate School" as well as the Associate Dean of Graduate Studies of McCormick. A student found guilty of academic dishonesty runs the risk of being dismissed immediately from the graduate program.

On Being a Scientist by the Governing Board of the National Research Council is available at http://www.nap.edu/catalog.php?record_id=12192#toc. Northwestern University's *Guidelines for Investigators in Scientific Research* is available online at <http://www.research.northwestern.edu/ori/misconduct/documents/GuidelinesforInvestigatorsinScientificResearch.pdf>. These two documents discuss ethical standards in the scientific community. Students should be familiar with the contents of these two documents. The Department expects the highest levels of integrity from students and faculty.

E. Work Obligation of Graduate Students and Other Limits on Outside Compensation

First year students fully supported by University Fellowships are expected to concentrate their full effort on their coursework and preparation for the written preliminary examinations. Teaching Assistants are expected to average 20 hours per week on their teaching responsibilities, the remaining workweek shall be dedicated to coursework and research. Students supported by research grants are expected to work on thesis research an average of no less than twenty hours per week while taking courses, and full time otherwise, for the research project from which the stipend, supplement and/or tuition are paid. Since most support monies are derived from government or industry contracts and grants, it is the students' responsibility to perform their assigned research tasks in a timely manner. It should be noted that most contracts require formal progress reports on the research performed.

Students are not to hold additional part-time jobs, except where there are exceptional extenuating circumstances and with the consent of the adviser and department chair.

F. Vacation Policy for Graduate Students

Students receiving financial aid through the University (Research Assistantships, Fellowships, Teaching Assistantships) are entitled to staff holidays. Please note that the breaks between academic quarters, such as at Christmas and spring break, are not vacation periods. Paid vacation or excused absences must be arranged in advance with the faculty adviser. A paid vacation of two weeks per year is considered normal for a student making satisfactory progress toward a degree. If approval from the adviser is not obtained before taking any time off, loss of financial support may result. Students electing not to take vacation are not entitled to any extra compensation.

G. Student Support and Conflict Resolution

Students should speak with the Department Chair to interact in a confidential manner when concerns arise.

H. Consumption of Alcoholic Beverages

Consumption of alcoholic beverages in the Technological Institute, except at official departmental functions and such recognized events as post-defense celebrations, is incompatible with sound safety and work-place practices and is therefore unacceptable. **We expect our students to abide by Illinois laws concerning all controlled substances.**

I. Student's File

Folders are kept in the department offices for each student. They contain application materials, approved study programs, grades for completed courses, records of completed examinations, names of committee members, current address, phone numbers, etc. In accordance with Government regulations a student is allowed access to his file after submitting a written request to the department. Educational records cannot be released to any outside agency without the student's written consent. Students applying for credit cards, etc., which require employment and/or salary verification by the department, must inform the department that such a request may be forthcoming. Verification of employment may also be done through NU's Employment Verification Infoline at <http://theworknumber.com>.

J. Change of Address

The Department Office must be notified of any change of address. Students may change address through the HR website <https://nuhr.northwestern.edu> and also in Caesar. Be sure to change your address in both as the two systems are separate.

The US Citizenship & Immigration Services (USCIS) requires every international student and scholar to report a change of address within 10 days of their move. It is critical for F-1 and J-1 students to update their address in CAESAR immediately upon their relocation. For J-1 and H-1 scholars they will need to inform the international office as soon as possible. All F-1 students, J-1 students and scholars, and H-1B scholars will also need to complete a change of address form (AR-11) available on the USCIS website at: <http://uscis.gov/>. Failure to do so will be a violation of their F1 or J1 status and could result in severe consequences for them and their dependent(s)!

K. International Students

Upon arrival all international students must register immediately with the International Student Office, 630 Dartmouth Place, Evanston Campus, who will act as adviser on all matters concerning employment practice, visa renewals, etc.

L. Colloquium Series

The Department organizes the colloquium series that meets on Mondays at 4pm. Its primary purpose is to broaden the education of each graduate student by bringing to campus the leaders in our field. Attendance is recommended for all graduate students, but **required** for all first-year graduate students.

M. Safety

The department has taken a number of steps to help provide a safe environment for your research. In the event of an alarm requiring evacuation of the building, all members of the department are expected to evacuate using preferably the stairwell at the north end of the hall near the main office. Proceed to the ground floor, then go north out the exit at the end of the C or D wing. After exiting the building, go to the department rally point at the entrance of Sargent Hall and report to the Safety Coordinator, Beth Siculan, so we can ensure everyone's

safe exit from the building.

N. Keys

Graduate students will receive a key for their office in the Technological Institute. In order to get your keys, you must obtain an application in the Department Office, to be filled out and returned to Edla D'Herckens with a key deposit of \$15 (cash only). **Keys must not be passed on to anyone else.** Students may not be in the Department Office after normal working hours, generally 8:30 AM to 5:00 PM.

O. Computer Lab

Computers (both Linux and Windows PCs) are available for individual use in the Department computer lab, M443. Computers facing the first aisle near the window are available for student use. These facilities are intended for academic use only. New students are assigned a user ID based on their NU net ID. Other individuals who require access may submit their request to the Department computing manager, David Chopp in M448. The Manager must be consulted prior to addition or deletion of any software or hardware on these systems, or in the event of system malfunctions. Access to the lab is by an access code for a numeric pad. Contact Beth Siculan if you do not know the access code. Please do not share the access code with non ESAM people.

P. Desk and Research Space Assignment

A desk for personal use will be assigned to each graduate student. The assignment of both desk and research space are handled by the Department on an annual basis. Office assignments may change each year, usually over the summer. No changes should be made without authorization of the Department Chair.

Q. Telephone, Fax, Mail, Photocopying, and Printing

Telephones. Personal calls should be made on cell phones. A telephone in the Computer Lab, M443, is provided for calls connected with University business. Long distance calls require an access code. Persons who may have occasion to call you for business purposes from outside the University should be given the telephone number of the main Department office (847)-491-3345. **Collect calls are not acceptable, by Northwestern regulations.**

Postal Service. Mail is delivered once a day to the Department Office. The student mailboxes are in M426; you will find your mail and messages in your assigned box above your name label. It is advisable to check your mailbox *daily*. Use of the University mailing address for personal mail is not allowed by NU regulations.

Photocopying, Copy Cards, and Faxing. A photocopying machine for research and teaching related copying are available in the Department Office. Copy cards for use in copying machines at the library are available through the Wildcard Office or at Seeley Mudd Library. Photocopying services are also located at Norris Center and 2020 Ridge for large orders. Personal copying should be kept to a minimum on the department machine. A fax machine is located in the Department Office. Long distance faxes require an access code. See the department for personal faxes.

Printing. A black and white and a color printer are provided in the Computer Lab, M443. The black and white printer should be used, with duplexing turned on to save paper, unless color is **absolutely necessary**. Use of the printer is for academic and research purposes only. Information about accessing the printers from the Department provided computers or your personal computer can be found on the Department website under student resources.

R. Automobile Regulations

The University Police Parking Division controls the NU parking lots. Students requiring a sticker that will enable them to park in the various University parking lots should obtain an application from the Parking Office located at 1819 Hinman, Evanston (open Monday through Friday, 8:00 A.M. to 4:00 P.M.). Applications are issued upon presenting your University I.D. card, driver's license and payment of a fee. Additional information can be found at www.northwestern.edu/up/parking. For your information, *all students who park cars on campus* are required to register the car with the Parking Office. Bicycles should also be registered.

S. The SIAM Student Group

The Northwestern Student chapter of SIAM (Society for Industrial and Applied Mathematics) was established in 2011. Each year (usually at the end of the Spring Quarter) an election is held to fill the offices of President, Vice President, Secretary/Treasurer, Activities Chairman, and Faculty Representative. The Officers serve as liaison to the Faculty and Department administration in representing the students' interests. They also organize various social and professional activities throughout the year. Students are automatically members and are encouraged to participate. For international students the club provides valuable interaction for the development of English proficiency.

T. U-Pass

All full-time students will receive a U-Pass, which allows unlimited rides on the CTA. Information about use of the U-Pass and distribution dates is available at <http://www.tgs.northwestern.edu/studentlife/Upass/>.

U. Bike Riding and Skateboarding

For obvious safety reasons, bike riding and skate boarding are prohibited in the corridors of Tech. **In addition, bikes may not be stored in public spaces in the building, in particular the stairwells where they can pose an evacuation hazard.**