Expectations of M.S. and Ph.D. Students

(This text was modified with permission from Dr. Derick G. Brown, Lehigh University to Dr. Paul Imhoff, University of Delaware)

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Introduction

This document provides current and prospective graduate students a description of general expectations during your studies at the University of Delaware. This document helps eliminate any misunderstandings as you work with me and in my research group.

You will spend the next few years immersed in research and study. During this time you will learn how to formulate research questions, you will develop the technical and analytical skills to address those questions, and you will learn how to communicate your results to a wide range of audiences. A substantial portion of your graduate studies will be spent performing advanced research where you will operate with considerably greater independence than you did as an undergraduate student. This independence can be a significant paradigm shift for students who just earned their undergraduate degree and are unfamiliar with performing independent research.

You will need to do in-depth literature reviews on your research topic, enhancing your understanding of both the broad field of study and the specific technical and analytical aspects of your research project. You will develop experimental procedures and protocols to investigate your topic in the field and/or laboratory, and you may work with mathematical models to understand the system you are investigating and/or to interpret your experimental results. This independence requires that you have the ability to learn and adapt; show initiative, be dependable and be self-motivated; and conduct your research to the highest standards.

It is important to realize that it takes a lot of work to earn a graduate degree. **Many students spend about 50-60 hours a week on classwork and research, and perhaps 40-50 hours per week when classes are not in session.** However, I do not require a set number of hours for work each week, nor do I want to micro-manage your time, nor do I want you to become a "slave" to your work. It is important to take time off; your work is not your life, but an important part of your life. I lead by example. I also work 50-60 hours per week in the office and additional hours at home.

Table 1 provides characteristics that are important to succeed in graduate school by comparing mediocre students to outstanding students. I only invite students to join my research group if I think they have the ability to be outstanding students. If you fall under the mediocre student category, you need to spend some time thinking why you want to perform graduate-level research.

Finally, graduate school should not be all hard work. It should be one of the best experiences of your life. You will have opportunities available to you that are not available in any other setting. You will make new friends/colleagues from different countries and likely with different research interests, you will learn that you can succeed at discovering new things through your research, you will travel for

field work and conferences, you will develop skills in sensor wiring and deployment, sensor trouble shooting, and Matlab and other data analysis packages, and you will develop a network of researchers from other institutions.

Table 1. Characteristics of Mediocre and Outstanding Students[1]

Characteristic	Mediocre Student	Outstanding Student
Work habits	Has a rigid view of research as a "9 to 5" job. Is not willing to come in on evenings or weekends when required to complete laboratory experiments or prepare for field work. Arrives in the late morning, spends an hour surfing the web, takes a long lunch, goes to the gym, leaves at 4:30 and tells him/herself that was a full workday. Takes shortcuts on experiments because the experiment is "taking too much time." Takes short cuts in preparing for field work because "we can figure it out when we get there". Only performs analysis at advisor's prodding.	Uses time efficiently and is willing to work non-standard hours to complete work requirements. Ensures work is performed to the highest standards. Proactively initiates research.
Journal reading	Reads only journal articles provided by advisor or other students.	Actively and continuously performs literature searches to independently locate journal articles.
Research hypothesis	Content to work on research hypotheses developed by research advisor or others.	Independently and continuously assesses research data, both from the student's project and that from other researchers, and formulates hypotheses describing observed phenomena.
Lab notebooks	Takes general notes, where the notebook acts more as a research diary.	Provides detailed descriptions of work done in the laboratory or field. Step-by-step descriptions and observations are recorded so that anyone using the notebook can completely understand what was done.
Writing	Only writes when forced by their advisor.	Continually writes, including maintaining updated literature review of pertinent topics, writing journal publications and reports, and developing research protocols and sensor "cheat sheets".
Publication	Looks at publication as an afterthought to the research. Minor effort put forth in developing manuscripts and assumes advisor will rework mediocre manuscripts or thesis/dissertation.	Realizes that publication of research results is paramount for PhD work, and focuses considerable effort in developing and writing manuscripts. Continuously develops new publication ideas and proactively approaches advisor with potential manuscript topics.

Problem solving	Comes to advisor seeking solutions to research problems. Tries a singular solution and then returns to advisor for future direction. Views research in small incremental steps where each is guided by the advisor.	Looks at research problems as an opportunity to grow and learn. Develops potential solutions to problems and **discusses** them with advisor.
Teamwork	Focuses solely on own research. Does not understand the benefit of teamwork and learning a new concept, procedure, sensor capability, and/or approach to solving a problem.	Understands that the collective output of the research team is a key component of the student's own success. Willingly assists others in the lab or field with projects and lab/field chores (even mundane ones).

[1]Adapted from a memo by Dr. R. Hughes, UMI, to his graduate students, dated 16 December 2003.

Philosophy of Advising Graduate Students

I want to prepare you to be an independent thinker, who is capable of formulating research questions; to be technically capable, so you can identify research questions and develop and implement research plans to address those questions; and to be an effective communicator in disseminating your research ideas and results to the scientific community and general public. As your research advisor, I will help you learn how to do research, including how to design and conduct appropriate experiments; analyze and interpret your data; document your results; present your results and publish your results where appropriate. I will act as your mentor, collaborator, counselor and advocate looking out for your best interests. I will provide professional development where possible and seek opportunities for you outside the immediate research group. In return, I expect you to work hard and be self-motivated, be diligent, conscientious, strive for excellence, and proactively initiate and conduct your research.

The M.S./M.C.E and Ph.D. degrees differ in the amount of work required to achieve the degree, the guidance provided by me in laying out the research problem, and the level of supervision.

> **M.S./M.C.E Thesis:** based on advanced research focusing on solving an engineering or scientific problem, with the problem and solution approach typically defined by close consultation with me. I strive to have M.S./M.C.E students submit a journal article based on their work but this is not always possible.
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> **Ph.D. Thesis:** represents a student's original and independent research that advances the field being studied. A Ph.D. typically involves the publication of one to three peer-reviewed research articles depending on the project and scope of work. The research topic is often dictated by an existing research grant and the generic hypotheses have already been identified in the proposal. The student should not rest on these hypotheses alone and instead seek alternate hypotheses and/or tangential directions in the research focus. Potential shifts in project focus are critical in the early stages as they may lead to alterations in experiment design and/or deployment strategy. The student will be largely responsible for experiment design, deployment, understanding how sensors work and how to collect data from them, data quality control, data archiving, data analysis and hypothesis testing, and results dissemination under my supervision.

I intend to provide numerous opportunities for you to build skills that will enhance your marketability following completion of your degree. For M.S./M.C.E students these may include oral and written communication, data analysis, fundamental coastal engineering principles,

networking and site visits. For Ph.D. students these may include oral and written communication, data analysis, fundamental coastal engineering principles, networking and site visits, help developing research ideas, proposal writing, budget preparation, paper writing, and feedback on teaching to name a few.

Expectations of Graduate Students

I expect hard work, creativity, ingenuity self-motivation and honesty from my students. I expect a willingness to pursue new ideas without fear of failure. A key requirement to join my research group is that my students must be fluent in English (both orally and written), as a significant portion of research involves presenting and publishing the research and results. For international students, my expectations are diminished only slightly, but you must still be sufficiently fluent in English such that your research and thesis/dissertation preparation are not hampered.

You are responsible for managing and conducting your research to the highest standards. This requires a responsible, independent and professional outlook on your part. I also expect that you be ethical in your approach to your research, your studies, and your interactions with fellow students and faculty. Examples of unethical behavior include plagiarism, cheating on coursework, fabricating experimental data, and behaving dishonestly or rudely with other students or university staff. Unethical behavior will result in dismissal from my research group.

I also have an expectation of continual progress and excellence in your research. Research should be carried through to completion including analyzing and writing up the results. Half-hearted efforts lead to poor results dissemination and lackluster theses/dissertations. Publication is important for M.S./M.C.E. students and critical for Ph.D. students. Progress in your research means trending towards publication of research findings especially for Ph.D. students.

You will be expected to present your research at national and international conferences. Learning to speak in public settings is critical for your future career. In addition, conference attendance allows you to build your network of peers. I will schedule weekly one-on-one meetings with each student to discuss their research and progress. This meeting provides an opportunity to address any issues you may be facing but is also an opportunity to showcase your communication skills.

All students are required to take shop safety training classes and must wear eye protection when working in the lab. Other safety gear must be worn when appropriate for the work being completed. Safety is taken seriously and should be the first, second and third consideration when working in the laboratory or field. Cutting corners on safety is never an option. You will be called out when acting in an unsafe manner and repeated warnings may be cause for removal from the research group.

You must document all your work. Maintain a notebook that is detailed and has a date on every page. Field and experimental notes are absolutely critical. When in doubt write it down. It is nearly impossible to remember details months after an experiment. If the details are not in a log book they will be lost. Students are responsible for backing up their own data. I maintain a data server and I provide each student with a backup drive for data. You can also use cloud services or drop box. More than one backup is a good idea.