Teaching Statement

I was originally attracted to an academic career in large part because of the opportunities it offers for teaching and mentoring activities. Over the past 5 years, my interest in teaching and mentoring has only become stronger and I believe that I have learned a lot and matured significantly in this time. I have taught more than 10 ECE classes at the freshman, sophomore, junior, senior and graduate levels. I have received mostly positive student feedback from these classes. I have also designed and built a new ECE undergraduate teaching laboratory with state-of-the-art equipment worth approximately $50,000, and I have designed and taught a hands-on class on "Introduction to Wireless" based on this lab.

I have successfully supervised one Ph.D dissertation and am currently advising (or co-advising) five Ph.D students. I have also supervised two MS theses and am currently co-supervising two other MS theses. I have presented guest lectures and department seminars. I have also sponsored and participated in IEEE student group events. I have served as an informal mentor for senior capstone design projects. I have served as academic advisor to more than 10 students on average each semester. I plan to continue this strong record of involvement in teaching and mentoring activities in future.

1 Teaching philosophy

Over the past 5 years, I have come to appreciate the University of Iowa as a large liberal arts university serving a student body of mostly middle-class and working-class backgrounds, and which as a public institution occupies a very special and influential place in the economic and cultural life of all citizens of the state of Iowa. This in turn means a personal recognition that as a faculty member, I have a responsibility to meet the expectations and contribute to the mission of this institution that is so important to so many people.

I have consistently striven in my teaching and mentoring to achieve a balance between two goals: (1) to train students for productive personal careers in industry, government or academia in their immediate future, and (2) to educate future leaders, entrepreneurs and citizens in the long-term.

At a very high level, I strongly believe that a well-educated electrical engineer would not only be knowledgeable in the technical ideas underlying engineering practice today, but would be in a position to *shape* the engineering practice of the future effectively for the benefit of society. I am strongly convinced that this requires an understanding of the conditions under which specific practices and technologies originated, how they evolved over time and how they were shaped by cultural and economic factors and so on.

Of course few people would disagree with these ideas, but I believe in practice they are under-emphasized because of the pressures of time and curricular requirements. My experience over the past 5 years of teaching has been most enlightening in this regard. I have learned from my interactions with students, that a significant portion of our undergraduate student body is made up of students who have other substantial commitments and responsibilities outside of their college work. I have met many students who are balancing their studies with a job or even multiple jobs and personal and family responsibilities. These students also have economic pressures that force them to complete their degrees as fast as possible. Our graduate student population is demographically very different from the undergraduate student body, and this presents a different set of challenges for teaching and mentoring at the graduate level.

Faced with such practical constraints, high-minded philosophical considerations cannot be given a high priority. Nevertheless, I have tried in my teaching to go beyond just technical training and work towards the

ideal of a well-rounded education. In order to do so, I have tried to adapt my teaching techniques to accommodate the needs of my students as much as possible, and a large part of this effort involved experimenting with technological tools in teaching. Along the way, I have learned a lot about the promises and limitations of technology for teaching.

2 Classroom techniques

The overall teaching techniques I have followed are fairly conventional to which I have added some novel technological components. Mainly I prefer an interactive mode of teaching; ideally this would involve a two way dialogue in the classroom with the active participation of students.

Of course, this is like motherhood and apple pie as in everyone is in favor of it, but I quickly learned that this is not at all easy to achieve in practice and takes a great deal of conscious and persistent effort. I believe I have made some progress over the past 5 years on how to do this effectively. For instance, I learned early on that it was important to be inclusive as well as interactive; otherwise there is a risk of creating hostility towards active participants from the rest of the class.

3 Use of computer technologies and online resources

I have tried to use computer technologies with caution in the classroom; in general I avoid the use of Powerpoint slides in lectures, in favor of simply using the blackboard (or a document camera when using lecture capture). However I do occasionally use slides to present audio-visual material to supplement lectures e.g. animations, video demos and drawings that would be awkward to replicate by hand.

I have also been using lecture capture for the past 5 semesters, and have made recordings of lectures freely available for streaming and download from my public website (http://www.engineering.uiowa.edu/∼rmudumbai/). This has been widely appreciated by students in every class. On the other hand, my attempts to use e-textbooks as part of a pilot project in a past semester did not prove to be very effective and I have since discontinued that effort.

At a mundane level, I have learned how to use the UI course management system ICON to communicate effectively and efficiently; this is very important especially for large classes. An important part of my education in this regard is figuring out what tools NOT to use - course management software such as ICON come loaded with features and it took me a while to overcome an initial temptation to overuse these features out of a kind of techno-philia.

For upper-division undergraduate and graduate classes, I have found it effective to supplement ICON with a more informal blog, which have been very popular in every class I have taught. I have found blogs to be useful because they are informal, anonymous and very flexible: depending on personal preferences, students have subscribed to the blog using RSS readers, email or simply used a web browser interface. Blogging software also nicely syndicates content for access on smart phones, mobile devices and tablets.

Recently, many institutions (including Iowa) have made available online - on YouTube, the iTunes store as well as traditional websites - a wealth of learning materials. Although there has recently been a deplorable hype especially surrounding MOOCs and attempts to use them inappropriately to undermine traditional education, the availability of these materials is nevertheless a very valuable resource. I have tried to bring this to the attention of students in my classes and strongly encouraged making full use of these. I make extensive use of these materials myself in my efforts to expand my own education and training.

4 Development of new wireless teaching laboratory

I have also taken the lead in developing the ECE department's new undergraduate teaching lab for wireless communication systems consisting of a number of software-defined transceivers along with two state-of-the-art RF oscilloscopes, a high frequency analog signal generator and a spectrum analyzer. I have designed and taught a hands-on class on Introduction to Wireless (as a special topics (055:195) class in Spring 2013) using this lab. In the design of the lab and the class, I have taken into account informal feedback from students and recent alumni indicating a strong interest in RF design and wireless communication. Thus a significant part of the class was devoted to the theory of operation of RF instrumentation which is traditionally not covered in communication systems classes.

My work on this lab is also a great example where I have used expertise gained from my wireless research to teaching. Specifically, we have been successfully in our research lab using a new family of software-defined radios as a platform for experimental demonstration of cooperative communication techniques. This platform also had some advantages for instructional purposes: it is a standardized open hardware platform supported by open-source software; thus skills acquired with this platform are likely to be more portable than using a non-standard proprietary system.

I plan to continue this effort to apply expertise gained from my research work to teaching.