UOIT
CHALLENGE INNOVATE CONNECT

Tenure Review Documentation

Prepared by
Ruth Milman

Aug. 15th, 2016

Table of Contents

Introduction

"I once asked a young dissertation writer whether her suddenly grayed hair was due to ill health or personal tragedy; she answered: "It was the footnotes"."

Joanna Russ

Curriculum Vitae

Ruth Milman
Assistant Professor
University of Ontario Institute of Technology
Faculty of Applied Science and Engineering
Department of Electrical, Computer and Software Engineering
Research Interests: Nonlinear Control Theory

As per Section 20.10.a.i of the UOIT Faculty Collective Agreement, this section contains my complete Curriculum Vitae in UOIT format.

Criteria for the Award of Tenure

– UOIT Faculty Collective Agreement, Section 20.02

a) The award of tenure is a career decision that shall reflect all of the candidate's academic and professional accomplishments at UOIT and elsewhere prior to the time of the consideration of tenure.31

b) Candidates for tenure are assessed on their Research, Teaching, and Service. Persons awarded tenure must show clear promise of continued contribution through a record of:

   i. research activity that includes peer reviewed publication and/or peer recognized creative professional practice; and
   ii. satisfactory performance in Teaching; and
   iii. satisfactory Service.

c) The availability of resources provided by the Employer will be taken into account when assessing Research, Teaching, and Service.

d) Evidence of Teaching and Research varies among the disciplines. Committees shall recognize this variation when assessing the evidence required by this Agreement and shall give consideration to both quantitative, qualitative and/or mixed methodologies as appropriate to the discipline.

Statement Addressing How the Criteria For Tenure Has Been Satisfied for Ruth Milman

August 15, 2016

Dear Colleagues

Please accept this statement in accordance with Section 20.10.a.ii of the UOIT Faulty Collective Agreement, valid July 1st, 2015-June 30th, 2018, addressing how I believe I have met the criteria for tenure. As per Section 20.10.a.ii, this statement includes three main sections that address the Research, Teaching and Service criteria as outlined in Section 20.02.

A. Research

> *"Persons awarded tenure must show clear promise of continued contribution through a record of: research activity that includes peer reviewed publication and/or peer recognized creative professional practice. "*
>
> UOIT Faculty Collective Agreement, Section 20.02.b

As can be seen by my CV and supporting Research Portfolio, I believe my research shows clear promise of continued contribution through a record of research activity that includes eight peer reviewed journal publications, 15 peer reviewed conference publications as well as three invited lectures on my research achievements. Since commencing at UOIT, I have been awarded four research grants including successfully competing in and receiving two consecutive NSERC Discovery Grants.

Since the start of the Electrical Engineering Graduate Program at UOIT I have supervised six graduate students, four of whom have completed their degrees. I am currently co-supervising one Ph.D. student and will have three Masters students in the upcoming academic year, two in September and one in January. Working with these HQP has been highly rewarding. In addition to supervision of graduate students, due to the young nature of the graduate program at UOIT, I have focused some of my research time on working with undergraduate students, where their thesis and capstone projects have been tailored to contribute towards parts of graduate level projects. Working on research-related projects with undergraduate students in this way has also been exciting for the students and has opened the door for many of these students to continue their studies as graduate students.

My research program itself has matured in my time at UOIT. Since graduating from the University of Toronto in the area of systems control theory, my early research at UOIT on computational methods for the quadratic sub-problem associated with linear model predictive control was to follow-up to my dissertation work. Since we are a small university and with no colleagues who do research in similar or related areas, I maintained my doctoral contacts and research as this helped me keep a clear research direction. The mentorship of my Ph.D. supervisor, Dr. Edward J. Davison has been invaluable throughout all of my research. While at UOIT my research program has grown and expanded to include path planning for environments with obstacles and the use of vision systems for obstacle detection, both in automotive and in robotic applications. Being involved in a multidisciplinary field, I have ensured that I spend some of my research efforts on applying control theory to areas in other disciplines in order to increase the stock of knowledge and further application of control theory to other research area

within Electrical and Mechanical Engineering. My main current research focus examines optimization within the framework of nonlinear MPC. My research program is expanded on in significantly greater detail in my research portfolio. These research areas are fascinating and I feel that my research in these areas shows clear and significant promise of continued contribution.

My research program did have an unexpected pause in it. In May 2010 I was in a car accident and suffered a permanent physical disability, forcing me to take a short term disability leave. The recovery from this accident was quite slow and made more difficult by some additional health issues. Unfortunately, due to the circumstances, some of my research work was dropped and even some completed work was never properly disseminated. Between May 2010 and August 2015, my work time was extremely disjointed with multiple leaves of absence. This has unfortunately had the impact of reducing the number of publications which I have authored. I have explained the impact of these leaves in more depth in a separate section, following this statement. In that statement I detail each of the leaves and the impact they have had on my research program. This period of time was difficult for my research program, which, between research, teaching and service, was the most affected. During this time I continued to supervise graduate students but I kept the number of students at a minimum to ensure that I would honour my commitments as a supervisor to my students even while on leave. Despite this disruption and its negative impact on my research and publications, I believe that I have clearly shown that I have contributed significantly to my field of research. The fact that I received two consecutive NSERC grants is an indication that my research has contributed in a significant way to my field. Having a second consecutive successful NSERC Discovery Grant is a clear indication of the valuable contributions of my research program.

Thankfully, since September 2015 I have enjoyed good health and there should not be any more disruption in my research program. Since that time I have been actively working on rebuilding my research program. I currently have several projects in various stages, including one that is almost complete and ready for dissemination. With three students starting this upcoming academic year, I will be able to expand and grow this research work. I believe that my record of successful peer-reviewed journal and conference publications as well as my track record of successful grant applications shows an "indication of clear promise of continued contribution".

B. Teaching

> *"Persons awarded tenure must show clear promise of continued contribution through a record of: satisfactory performance in Teaching."*
>
> UOIT Faculty Collective Agreement, Section 20.02.b

As can be seen by my CV and supporting Teaching Dossier, I believe my performance has surpassed the criteria of "satisfactory performance in Teaching" and my engagement in the teaching process, which I describe in detail in my Teaching Dossier, is evidence of clear promise of continued contribution.

When I commenced my position as Assistant Professor at UOIT, the Engineering program was in its early years and the current undergraduate Electrical Engineering class was commencing its third year. This posed a special opportunity, as I was able to make a true impact in the design and development of courses. In particular, it is not often that a new professor is given the opportunity to design and develop courses from scratch. In the undergraduate Electrical and Software programs, I designed and developed four undergraduate courses. Two of these were courses taught for the first time to the first cohort of students and two of these were courses that were previously taught but which I redesigned and updated.

In addition to the undergraduate courses, in my second year at UOIT we began our graduate program in Electrical Engineering. I have developed and taught three courses for our Electrical Engineering graduate program, two of which were developed and designed for UOIT in my area of research. In addition to the three courses, I have designed, developed and taught three additional directed studies courses, which were necessary to fill in important background for my graduate students. Details about all of these courses and my contributions to them can be found in my Teaching Dossier.

Teaching comes in many forms, and mentorship and supervision are a critical element of one-on-one teaching. In addition to the ten different courses, which I have taught, during the time that I have spent at UOIT, I have directly supervised six graduate students, 13 capstone/thesis projects with 36 undergraduate students, as well as seven summer undergraduate summer projects. I have also mentored numerous students from my courses and, as my students would attest, I ensure that they are always aware that my door is open to helping any student at any time.

C. Service

> *"Persons awarded tenure must show clear promise of continued contribution through a record of satisfactory Service. "*
>
> UOIT Faculty Collective Agreement, Section 20.02.b

As can be seen in my CV and supporting Service Portfolio, I believe my record has surpassed the criteria of "satisfactory Service" and my engagement in service to UOIT, which I describe in detail in my Service Portfolio, is evidence of clear promise of continued contribution.

Universities are very special communities in which the faculty members, the students and the administration are all integral to our great successes. Being a faculty member is not just a job; as part of this community, participating in service to all sectors of the university is important to me. In every aspect of what we do, being a role model to the students while helping to build and better the university community is part of what makes this so much more than just a job. Throughout my employment at UOIT I have always involved myself in all aspects of Service at UOIT. This includes service to my University, my Faculty as well as other Faculties, my Department as well as my Faculty Association.

I have participated in many committees as part of my service. On the University level, this includes being a member of the Research Ethics Board, the University Partnership Committee, the Teaching Evaluation Committee as well as being a university-wide representative on Academic Council. On the Faculty level, this includes being a member of the Program Review Committee, the FEAS Change Committee and helping promote our faculty as a part of the Engineering Viewbook Committee. I have served on the hiring committee for the Mathematics Department as well. For the Department, I have been a part of the ECSE Program Committee and the Curriculum Committee. These are only some of the ways in which I have contributed in my Service – a full list of service and my contribution to it is contained in Section III of my Tenure Review documentation. I have been an active member of each of the committees on which I have served and I believe that I have made an impact through my contributions. This is an extremely rewarding part of being a faculty member and I will continue to contribute, in order to help better the university and to be a strong part of the community which we are building at UOIT.

In addition to committee work, as professors we often have a chance to make a service impact in many other ways as well. I have frequently participated in the Ontario University Fair in order to help promote UOIT and help excite new students to the possibilities we can bring them. It is amazing when you meet a high school student at the OUF and then see them as new students following this. Though

this may be one of the types of service with the least time commitment, it is an important example of the rewarding nature of service. Recently I was invited to meet with our female applicants who had received acceptances from UOIT to talk with them. One was a woman whom I recognized as I had spoken to her at this past OUF. She had remembered speaking to me and mentioned that this conversation was one of the things that helped her make the decision to apply to UOIT; a little step on my part but it went a long way in her decision.

D. Additional Statement on Context for Research, Teaching and Service and Availability of Resources

> "The candidate has the right to include in this statement a subsection that specifically addresses the context for Research, Teaching, and Service activities over the probationary period and, if applicable, the availability of resources provided by the Employer and its effect on their Research, Teaching, and Service."
>
> UOIT Faculty Collective Agreement, Section 20.10.a.ii

When I began my position at UOIT, the undergraduate Electrical Engineering program was still in the process of being developed and the then current cohort was in its third year. In my second year at UOIT, the graduate program was initiated. The early stages of the University's development attracted me to UOIT as I wanted to have the opportunity to matter and to really make an impact. I feel that I have definitely had the opportunity to contribute to the growth of the university, but the early stages of the electrical engineering program at UOIT definitely had an impact and affect on each of the areas of Research, Teaching, and Service.

UOIT had no graduate students when I first began, and thus, research was slower that it would be at a more established university and teaching was challenging. Even when the graduate program began, there were very few students in the first years and no senior graduate students, so every aspect of the program needed to grow, taking significant time and resources on the part of myself, and all faculty member colleagues. This had a noticeable impact both on Research and on Teaching. From the perspective of Research, it is noticeably harder to diversify research and to accomplish what we want since often much of the research must be done on our own without the ability to expand on it with graduate students. From the perspective of Teaching this meant that there were no graduate student TAs in the beginning and even when the graduate program first started, TAs were lacking in experience with no senior peers to mentor them. This meant that a significant amount of my time needed to be spent training TAs and so the teaching load was heavier than it may appear to be as I had more responsibilities within teaching than I would have in a more established university. This also meant that my research program had a slower start. Even now, we have fewer domestic student applicants, which can make funding more challenging. This situation is definitely beginning to improve, though I still find it difficult to find TAs for the modern control course as our graduate students are often not trained in that area, so training a new TA takes a significant amount of time. Thankfully for my other courses this situation has improved.

In addition to the general challenges of being at a young university, I have had the additional challenge of having little support for my research area. It has been extremely hard to attract students to control theory research at UOIT because we do not offer a sufficient number of graduate courses in the area. Because UOIT's resources are tight, a very limited number of graduate courses run on a regular basis, which makes it hard for our graduate students to find appropriate courses to take. Currently, I have 3 graduate students entering the program in September and yet we don't even have enough resources for me to teach a graduate course in my area, which means that there are no course to prepare my students for their research so I will have to teach each of them a directed studies course (for which I get no credit) in order to prepare them. To compound the limitations in graduate courses in controls, our

undergraduate students have not had any advanced control courses in the past several years due to a lack of resources. Many students have lobbied for the courses and there is clear interest, but they consistently are told that the numbers do not support having the courses run. The issue is similar with electives. I present this by way of explanation that on a practical level, our undergraduate students are not well prepared to go into research in my research program and I must spend a significant amount of extra time training them compared to what would need to be done at other more established universities.

In addition, when I first commenced at UOIT there were no resources or space for research labs. It was not until my sixth year at UOIT that there was even any space for me to have a research lab, and when we did finally get some research space, our research lab doubles as open concept TA offices, making it difficult to house laboratory setups. It is difficult to do practical research when space for labs is limited. The tight resources we face means that even now, we have little to no support for some supports such as research computers.

Being a young university with a relatively new graduate program also has an effect on the availability of funding and grants. Statistics show that a significantly smaller number of grants are available to universities in our category, and it is much harder to succeed in a grant application, yet in order to accept graduate students, we need to have those grants in order to have sufficient funds. This limits our availability to accept students, which in turn limits some of our productivity in research.

In addition to the difficulties of starting at a new university which has had limited resources, I have had personal health issues which have made some of my time disjointed and have slowed down my research progress. I describe the delays and their impact in more detail in the next section. From May 2010 through August 2015, I have had a series of health related issues, which has caused me to lose significant time at work. This has had its worst impact on my research, as it was hard to concentrate on building my program when my research time was so disjointed. Thankfully this seems to be in the past and since September 2015, I have enjoyed better health and as such have been able to focus on rebuilding my research program.

All of this has definitely had the affect of slowing my research program, yet despite all of these difficulties, I feel that I have had many successes. I have had four graduate students successfully complete their graduate degrees, and I have mentored and supervised many undergraduate students who have graduated and moved on to be productive engineers. I believe that my CV and accompanying tenure documentation, including my research portfolio, teaching dossier and service portfolio, show that I have surpassed the criteria for tenure.

Thank you for your consideration,

Ruth Milman
Assistant Professor
University of Ontario Institute of Technology
Faculty of Applied Science and Engineering
Department of Electrical, Computer and Software Engineering

Part II – Teaching

"Tell me and I forget.
Teach me and I remember.
Involve me and I learn."

Benjamin Franklin

Candidate's Statement on Teaching

teach·ing

noun:

1. the occupation, profession, or work of a teacher.
2. ideas or principles taught by an authority.

verb: (used with object**), teach, taught, teaching.**

1. to impart knowledge of or skill in; give instruction in:
2. to impart knowledge or skill to; give instruction to:

synonyms: inform, enlighten, discipline, drill, school, indoctrinate; coach.

Dictionary.com

"**Teaching** using pedagogy also involve assessing the educational levels of the students on particular skills. Understanding the pedagogy of the students in a classroom involves using differentiated instruction as well as supervision to meet the needs of all students in the classroom. Pedagogy can be thought of in two manners. First, teaching itself can be taught in many different ways, hence, using a pedagogy of teaching styles. Second, the pedagogy of the learners comes into play when a teacher assesses the pedagogic diversity of his/her students and differentiates for the individual students accordingly."

Teaching - Wikipedia, the free encyclopedia

Universities are known as pillars of higher learning – a place where new philosophies can be born and where learning is taken to the next level. All this can only be possible through the establishment of a good foundation of teaching. Good teaching is founded on a solid teaching philosophy and on the pedagogy of learning. The importance of this can not be undermined, for, though a University is made up of many strata, a University could not exist without it's students, and those students would not be students without the a faculty to teach them. The relationship between faculty and students is a critical one, and in any research-based university, the tasks of teaching extend beyond the formal classroom and into the research domain through the guise of supervision. This makes the task of establishing an appropriate teaching pedagogy all the more daunting, yet equally all the more meaningful.

Since joining UOIT I have been immersed in the tasks of not only teaching courses but also creating and designing appropriate courses for an Electrical Engineering Curriculum. When I commenced my position as an Assistant Professor the undergraduate class was entering its third year and in my very first teaching semester I was given the task of designing courses that had never been taught at UOIT prior to this. This posed a special opportunity, as it is not often that a new professor is given the opportunity to design and develop courses from scratch. As part of my teaching, I have developed, designed or redesigned 4 different undergraduate courses while at UOIT. In my second year at UOIT the Electrical Engineering graduate program was approved and opened. I developed and designed 3 graduate courses for this program as well as developing 3 distinct directed studies courses to help fill in necessary background for my graduate students. It has been exciting to be a part of building the ECSE graduate and undergraduate programs at UOIT and this engagement in the teaching process has been rewarding.

In order to assist me with my teaching efforts and to help me become the best teacher that I can be, I have immersed myself in various professional development courses throughout my time at UOIT. I have participated in 9 different courses and workshops and I intend to continue my learning and professional development in order to learn more about teaching methods and pedagogy so that my teaching methods can remain as effective and relevant as possible.

Teaching comes in many forms, and mentorship and supervision are a critical element of one on one teaching. In addition to the ten different courses, which I have taught, during the time that I have spent at UOIT, I have directly supervised 6 graduate students, 13 capstone/thesis projects with 36 undergraduate students, as well as 7 undergraduate summer projects. I have also mentored numerous students from my courses and as my students would attest, I ensure that they are always aware that my door is open to helping any student at any time. In supervising and mentoring these students through their research projects, the roles of research and teaching come together. It can never be only about the research, as effective teaching skills are critical to the success of guiding students within these projects through the research process.

In my Teaching Dossier, which follows this section, I illustrate my teaching philosophies and objectives and how I go about meeting these objectives through my teaching strategies and accomplishments. Section I of my Teaching Dossier focuses on my approach to teaching, illustrating my teaching philosophies, teaching strategies, self evaluation and professional development. Section II focuses on teaching responsibilities and contributions, listing courses taught, student supervision and related teaching contributions. In Section III, I provide examples of these contributions, including the most current course outline for all courses taught as well as some sample lectures, projects and testing. This section of my tenure review documentation provides details to illustrate how, through my engagement in the teaching process and through my teaching accomplishments, I have surpassed the criteria for tenure review, showing “clear promise of continued contribution through a record of satisfactory performance in Teaching”.

Teaching Dossier

Section 1:

Approach to Teaching

A. *Statement of Teaching Philosophy*

> ***"Education is not the learning of facts, but the training of the mind to think."***
>
> **Albert Einstein**

As an assistant professor in a university setting, I interact with students on many different levels on a daily basis. This interaction includes both direct and indirect teaching and it is critically important not to loose site of the fact that when giving a lecture and when supervising or mentoring students, our main job within this interaction is that of a teacher.

It is my belief that when done right, teaching enriches both the lives of the teacher and the student. A good teacher is able to involve the student in the material, thereby enabling the student to absorb the material into their library of knowledge and to later apply it when necessary. As engineering students, application of knowledge is even more critical - it is important that students not only learn material but that they go further than this and that they are able to understand how to apply their knowledge in the context of engineering design. I believe that as a faculty member, I have several important obligations to my students. In the classroom setting we are responsible for teaching our students the course materials so that they understand the concepts that they were taught and they can take those ideas with them to their future careers. Particularly, in engineering, the technical knowledge which students must gain in their undergraduate university careers will usually be applied in their future employment, thus it is our job to teach the students the fundamentals that they will need to succeed. This lines up with UOIT's strategic plan of preparing our graduates for the evolving 21st century workplace. These fundamentals include knowledge of the technology itself, as well as appropriate learning skills and the confidence to apply these skills to the real world problems that they will encounter. As part of the skills required of an engineer, I believe it is critical to teach students strategies in order to allow them to tackle larger design problems by breaking them down into modular problems of smaller sizes. This is a life skill that they will likely need in order to succeed in their future workplace.

Achieving these goals involves presentation of appropriate course material, which has been kept up to date, in a manner that will engage the students so that they can both learn and retain this knowledge. They should then be encouraged to go one step further and apply this knowledge to engineering design. As a teacher, I have often found that every time I teach a course, no matter how many times I have done so in the past, I always find new insights into the material, and often even I learn something new when I prepare for my classes. This is a byproduct of looking at material and thinking about the different ways

in which I can present that knowledge to the students. I try to use my excitement about these new insights in order to help motivate and excite the students too. I believe that as part of our teaching, it is also important to build our courses in such a way that the students are set up for a successful learning experience in which they not only learn what they are supposed to, but also gain confidence in their ability. Knowledge without the confidence to apply that knowledge only provides a small fraction of what is needed. In order to help students gain the confidence they need it is important to assess their work fairly, to give projects and assignments which have reasonable goals and expectations and to ensure that testing is at an appropriate level – where students are challenged, but not beyond a level where they are capable of succeeding.

Where applicable, we must also make sure that laboratories are relevant and kept up to date, so that the application of technology which relates to the courses we teach will also help the students learn the skills they will need. It is important that the link between the labs and the course material is clear so that students know what is expected of them and can successfully see their technology in action. I believe that the job of a good teacher is to guide the student through the learning process, a process which occurs in many places, the lecture hall, the laboratories, and even in their own homes as they tackle projects, homework and studying. Metaphorically, when doing their work, students must be given space to stretch their wings, thus allowing them to learn to fly. University, from undergraduate programs through to doctoral programs, is a place where students must be expected to mature from young adults into professionals in their fields. It is only through learning to think independently that this can happen.

When preparing classroom materials, it is important to focus on active learning strategies where possible both because this helps students to retain the knowledge that they have gained and because this also promotes learning the skills that will be required to apply that technology. It is also critical to understand that each student is an individual with their own skills and weaknesses so that we want to make sure we are not biasing our teaching and testing to only one type of learner, but rather that we incorporate multiple learning strategies so that everyone has a fair chance of success. I also believe in second chances – I believe that we should try to give our students every reasonable chance possible to prove themselves and to succeed – but ultimately we do need to ensure that they have actually made an effort and succeeded in demonstrating that they have met our course objectives. Second chances allow students to be more motivated, knowing they are able to excel even if they had trouble in the beginning. Thus, as a teacher in an engineering program which must stand up to high academic and accreditation standards there is one more difficult but nonetheless important consideration which I believe must be addressed. Though we want each of our students to succeed, this must be a genuine success. Thus it is also critically important to judge the ability of our students and to ensure that students who do not have the capacity or capability to succeed in engineering school are not passed through the system simply because we do not want them to fail. It is critical that grades are not inflated and that the grades we give our students are a true measure of their ability and of their success in learning what we have endeavoured to teach them.

Our responsibilities to the students extend beyond simple teaching and lectures. Outside of the classroom we are still teaching our students when we give them advice or when we try to lead them on their path of higher learning. Even when we are not aware of it, we are teaching the students who cross our paths by virtue of role modelling values and expectations within our own careers. The way we treat our students and our willingness to mentor our students to become ethical adults who are ready to enter the working force is important because they will take to heart and often they will unwittingly mimic what they see when they move on to their own careers. As such, another critical aspect of teaching is the teacher-student relationship. Wherever possible, mentorship should form part of the teaching pattern. Furthermore, every good teacher must recognize that all people have both strengths and weaknesses –a

student can often have a good insight that sometimes even a teacher may have missed. By being humble as a teacher and keeping an open mind, while sharing knowledge with the students, everyone, including the teacher gets a chance to learn something new. One of the most valuable lessons I learned from my Ph.D. supervisor, Professor Edward J. Davison, is the importance of respecting one's students and realizing that even though you may be the teacher in a given situation, the students are people who have their own set of skills and strengths and they will grow to be our peers one day. Professor Davison was a phenomenal mentor and I value the indirect lessons he taught me about the importance of mentorship and good role-modeling within the teaching process. I strive to use those lessons and my positive experiences as a model within my own teaching pedagogy. I believe that we must always treat our students with manners and with respect and we must make time to help them both with questions they may have about the coursework and also with any other questions which they may have. We must be available to our students. Teaching our students to be successful engineers who will enter the workforce as responsible adults cannot happen only in the classroom. Treating students as colleagues often gives them the chance to grow as students. Genuine mentorship is vital for true success. By following these guiding principles we can help achieve another pillar of UOIT's strategic plan – we can truly be a healthy 21st century workplace.

Last, but not least, every teacher needs to be a student too - as an open minded teacher I can learn from my students. I believe that it is my responsibility as a teacher to better myself and to acknowledge both my successes and my failures. The strategies that were successful while teaching a course should be repeated and those strategies that were not should be amended so that the next time a course is taught it can be an even greater success than the previous time. Using my experiences to improve my teaching is a vital part of being a good teacher. Nothing can compare to the satisfaction received from passing knowledge on to a student in a successful way and then watching that student succeed in their future endeavours. Students are our future and I believe that teaching them well is fundamentally important.

If I had to sum up my teaching philosophy in one sentence, whether the students be preschool children all the way through to doctoral students, Albert Einstein sums it up perfectly – "Teaching is not the learning of facts, but the training of the mind to think."

B. Teaching Strategies

> ***"The best teachers are those who show you where to look but don't tell you what to see."***
> **Alexandra K. Trenfor**

During one of my UOIT orientation programs, somebody had pointed out that as a professor, we are in the minority and that if we look back at our own university days and consider the people who sat around us, we are likely very different from the average student. As such, it is critical to remember that our own experiences within the classroom are often not be the right ones to draw on when trying to understand the psyche and learning style of a student in our classrooms. There are many different learning styles – some students are visual/spatial, some are auditory, some are verbal and some are physical. In keeping with this, in order to maximize successes in the classroom, I try to ensure that I teach in a manner which allows for each of the different types of learners to benefit, without making any assumptions about what success looked like in my own experiences.

Active Learning While Teaching to Multiple Learning Styles

At UOIT we pride ourselves in our technological approach to teaching and learning. This can be both a mixed blessing and curse. Active learning is critical to a student's absorbing the material and being able to apply it, but technology in the form of a laptop at each desk is equally capable of distracting students from the task of learning. In order to try to keep the student's attention I believe in using active learning strategies to keep students engaged. In a large undergraduate classroom this can be a challenge. To help achieve these goals, as part of my lecture slides, I leave blank areas where I fill out information and students are expected to take notes on how I solve problems in front of them. In order to facilitate this process I post blank lecture slides in advance. For those students who have trouble note-taking I also post the filled in lecture slides after class, though I wait a few days so that students do have incentive to fill their own slides in if they want to have study material right away. I clearly explain to students in the beginning of the course that part of the advantage of going to lectures is that I do a lot of verbal explanations of why things are done and what the best strategies are. These things are not written down so they need to take their own notes on these verbal pointers as they won't be in the marked up slides. Between the verbal pointers and comments, the figures and tables which start out on the slides and the writing into the slides I try to touch on many different learning patterns throughout my lectures, giving students the greatest chance possible to have at least some of the material match their best learning style.

Ensuring that Lecture Materials are Engaging

University students are young adults, and as such, each with their own learning style, and though lectures form a critical part of the teaching process, students should choose to attend lectures because they can see the benefit. This means that lectures must be helpful to students, providing something that is above and beyond what can be found in their textbook. It is critical to ensure that lectures are engaging and I believe that it is my job as a teacher to provide something in my lectures that isn't simply to be found elsewhere.

Learning by Example – The Importance of Design

In line with my teaching philosophy I believe that young engineering students need to learn to apply the knowledge they gained in the course to larger scale design problems. In order to help students learn how to use knowledge as a tools in the design process, I teach the process through examples. Throughout the course I ensure there are always simple examples that illustrate each concept. Towards the end of any unit I use some larger examples. The examples throughout the course are good examples for understanding concepts, but to fully understand the importance of design they need more than that. When I structure my courses, I try to ensure that all primary problem solving tools which are to be covered by the course are taught within the first 10 weeks of the course. I keep the 2 weeks at the end of each course devoted for solving larger scale design problems in class.

Open Door Policy

I believe that keeping the educational bar high is important, in particular in the Faculty of Engineering, where the programs must be rigidly managed in order to meet the expectations of CEAB and the accreditation process. Sometimes this means that students have trouble with material or need extra help. In order to ensure that all students have the opportunity to learn material, I let all my students know that I have an "open door policy". This means that students are ALWAYS welcome to come to my office for extra help – even after a course is finished. Though I have formal office hours, I make sure my students know that they are welcome anytime – and that if they have come at off hours and they don't

see me, they should always send me an email to set up a meeting. During teaching terms I often spend many additional hours helping the students. This is worth it to me, as I want to ensure that they have every opportunity to learn the material and that they have every chance to excel.

One of the effects of my open door policy is that I have often had my graduate students come by a year or two after they have done their course in order to ask questions. This is one of the things I find particularly rewarding as it means that they are using the material I taught them towards their own research goals – which is one of my objectives.

Mentorship within Teaching

Part of teaching is mentorship, and part of mentorship is setting yourself up as a good role-model. The students who come to my office always know that I am there for them, and I have mentored many students as part of the teaching process. This is both an obligation to the teaching profession as well as a rewarding result of good teaching.

Undergraduate Teaching

Though the teaching goal may be the same from preschoolers though to doctoral students, the pedagogy of methodology and the strategies for what needs to be accomplished changes depending on the stage a student is in. When teaching undergraduate engineering students, I believe it that no matter what the subject material, it is important to ensure that they are taught in a way which helps them mature by learning to think for themselves, thereby learning to apply their knowledge to problems in creative ways. Once they graduate, these students will have the potential of being professional engineers – as such it is not acceptable to lower the bar. This can sometimes be difficult for undergraduate students in their earlier years, as many of the students have become accustomed from high school both to getting high grades and to having material simplified, with testing only ever covering small simple problems. In my experience they are resistant to learning to apply knowledge in a broader sense, yet this is a critical life skill for future engineers. Often they are more fixated on getting high grades than on the process of learning.

When teaching undergraduate engineering students, it is my philosophy that they strive to learn how to use the material that is being taught to them as design tools, applying their new knowledge to the engineering design process. Many of the undergraduate classes that I have taught at UOIT are large classes, in some instances as large as 120 students in a single classroom. Unfortunately the large class format limits the ways in which students can participate, and yet I believe that active learning is critical to the teaching process.

Lecture Slides

When formatting my undergraduate lectures, I always set up PowerPoint presentations as a base to my lectures. These are typically just a shell with titles, and a few points. In order to ensure that students are engaged in the process, I write on these PowerPoint slides in class, filling in critical information and solving problems in front of the students. By writing in these instead of having information prepopulated, students have the benefit of watching how a problem should get solved.

Projects

Part of my teaching philosophy is that young future engineers need to learn how to apply the knowledge gained in their courses to engineering design. As part of my second year Digital Systems course I always include a project in which they must apply the tools of digital systems to an engineering design problem. They must design a digital system, write a report on their design, and build at least part of their system. This past year I updated the project in several ways, one of which was to include a demonstration day for students where they then demo their projects to the whole class.

Homework

In order to truly learn a concept one needs to apply that concept and learn where the pitfalls are and how to successfully make use of the new tools they have learned. In order to ensure that students are trying things out, when covering more difficult concepts in class I give suggested homework to my classes. This way they have a reasonable problem to try out. As incentive to try the problems, I let the students know that I will often use problems similar to the suggested homework in the testing. I tell students this at the beginning of the term so they know that these are areas they need to focus on.

Testing

In my undergraduate courses I always give students two midterms and a standard format 3 hour final exam. Testing always includes some short answer questions that are simple and some longer questions in which they need to creatively apply what they have learned to solve a larger scale problem. Where possible, the larger problem mimics part of a design problem. This is specifically designed in order to ensure that students are learning to apply their knowledge. Since questions are typically very different than the simple questions in the back of a textbook, I ensure that I provide students with all of my old tests and exams both with and without solutions written in, so they have a bank of questions to practice from.

Incentive to Improve Performance

Testing the students' ability to apply knowledge to more difficult problems is something many students are not used to. I often find that students underestimate this and frequently do not study appropriately for their first test. In order to give students incentive to improve their performance and to give them a chance to learn how to apply knowledge instead of regurgitate it, I have a simple grading policy that I share with them from the very beginning. I tell students that as long as they improve from the first midterm to the second to the final exam, I am willing to drop the lower marks and replace them with the higher mark from the next test. This lines up with my philosophy that everybody deserves a second chance, yet grades must be genuinely earned.

Graduate Course Teaching

It is important to understand that though the main objective of teaching is always to pass on information from teacher to student, so that the student internalizes the new knowledge so they can then apply it to more complex problems, the pedagogy of how one is able to relay that knowledge becomes quite different as students mature. In particular, there is a huge gap between the level of maturity in both attitude and knowledge of a graduate student vs. an undergraduate student. As such, I

firmly believe that both the teaching philosophy and the teaching methods should be quite different when teaching undergraduate students compared to when teaching graduate students.

It is my philosophy that when teaching graduate students, they should be treated as colleagues and guided to learn how to find the information they require to enable them to learn to solve research problems. This is partially accomplished by teaching students how to creatively find the tools needed to systematically test for solutions to their research questions. Graduate students, in particular the doctoral students, are future researchers and they need to recognize that often, while doing their graduate research, they may collect more knowledge in a field than others around them. It is our job to teach them how to use that knowledge to accomplish research goals, and as such they are not only learning material when they take a course, they are learning what it means to learn more material for the purpose of solving research problems. As part of their graduate degree they are maturing into researchers and they are really learning what it means to be colleagues and to use collegial relationships to both gain and impart knowledge. It is our job as teachers of graduate students to help guide this maturation. When structuring graduate course teaching, my teaching strategies are based on my philosophies about graduate students. As such, there are several key things that I focus on for my graduate courses.

Collegial Atmosphere

One of the first things I tell the students of any graduate class that I teach is that I intend to treat them as colleagues. There are areas in which they have more knowledge than me and areas in which I have more knowledge than them. That ultimately means that we can all learn from each other. I find that raising the bar of knowledge in this way has a positive impact on the learning environment.

Participation

Graduate classes by nature are typically drastically smaller than undergraduate courses. Having a small group of students allows for a more intimate classroom style and as such I encourage students to participate as much as possible. As part of this I encourage a discussion format whenever possible.

Homework

When teaching graduate classes, I encourage students to try out each of the methods discussed in class that day. A simulation of the method learned in class is given as homework. In order to facilitate participation, that homework is taken up by the students at the beginning of the next class.

Projects

As part of any graduate course, I try to ensure that students will have the opportunity to apply the material they have learned in my course to a research problem in their area of interest. I allot a large percentage of the course grades for this project. One of my fundamental objectives in my teaching for graduate students is to ensure that students learn to tackle real research problems using material they have learned in my graduate course. The project is typically structured to mimic a conference paper/presentation; students chose a research problem from their area of study, creatively apply a solution to their research problem from the course material, write a paper which they hand in to me, then present their work in front of the class. In this way they both learn a skill which is important to

researchers and they have the opportunity to apply some of their new knowledge to their research areas where possible.

Exams

I find that using a standard 3 hour exam format does not allow for testing the application of knowledge at a graduate level. As such I always schedule my graduate student exams as a take home exam. I give them a guide as to my expectations for the amount of time the exam will take and I treat their time with respect, allowing them to choose the timing so that they are able to balance all of their responsibilities without having my exam as a stressor to their time. The expectation is typically that if they have done all of their coursework and understood it properly, the exam should take them approximately two days to complete. Within the content of the exam I try to have one or two programming problem that mimic homework and one analysis problem that mimics homework. In addition, there is always one problem that is new to them – for example, in my optimization course, I would give them reading about a new optimization method they haven't learned in class and a problem to solve using that optimization method. Students are aware in advance that this will form part of their exam, so it does not come as a surprise to them. The purpose of this is to ensure that they understand the importance of the learning process and that they understand that part of the goals of the course is to give them the tools to be able to understand how to apply this material to their future research needs.

Using these basic tools I strive to teach my graduate students at a level that is appropriate for them.

Supervision of Students

Teaching clearly happens while in the classroom, but it is important to recognize that teaching happens outside of the classroom as well. Supervising and mentoring students is also a critical teaching activity and it is important to have some strategies for supervision and mentorship. Sometimes this is part of a formal teaching load, such as a capstone project. Sometimes this appears to be part of research, in particular when hiring summer students or taking on graduate students. Sometimes this is more informal, and simply occurs as a result of students coming to my office to ask questions or to get help.

Project Supervision

One of the key strategies for supervising projects is to have regular weekly meetings with students. Though this seems trivial, it is an important strategy for success. Having regular weekly meetings with students ensures that they stay on track and that the project does not simply get pushed aside when students get busy with other things, possibly then realizing too late that they hadn't allotted sufficient time for the project work. One of the first things I tell my capstone project groups is that they must meet with me each week, even when they have not accomplished anything. I jokingly tell them that if they need to they can come to the meeting and tell me they have done nothing all week, but that they must still come to a meeting. I point out that since it is embarrassing to come week after week saying they have done nothing I'm sure this will help them keep on track. In addition to weekly meetings, as part of my strategy towards successful project supervision, I ask students to create a plan for time management, setting milestones throughout the project. These can be re-evaluated and reset as required, but I try to instill in the students an understanding that they always need to have a plan in order to help ensure that their projects are a success.

Guided Learning

It is part of my philosophy that students should be guided to learn, and as part of this, I find that it is important to have strategies on how to accomplish this. When supervising students, I make sure that they know up front that I will not be providing them with all the answers, rather that they should expect me to help guide them to finding solutions to their problems. As part of the strategies for guiding students to learn, I always make sure that when making suggestions I point out multiple approaches that they can take, pointing out some of the pros and cons of each method and allowing students to make choices for themselves. I will warn them of pitfalls in their choices, but since it is their project, they do need to be allowed to make mistakes. Sometimes students can learn more from their mistakes than they can from being told in the first place how to do something right, with no leeway for making their own choices.

Teaching Strategies Specific to the Use of Technology

Here at UOIT we pride ourselves on being a laptop university. Though the laptop program is changing, through most of my years at UOIT this was emphasized and I have worked with this framework in my lectures. The laptop system comes with some distinct advantages:

- Our students have a laptop which is preloaded with industry standard software. As a teacher this is a great advantage to me because I can structure my course to ensure that students become familiar with some of the tools that they will need when they enter the workforce. As well, I always know that the students and I are both working off of the same software so I can rely on availability of these tools, which I also posses, to the students.
- As a professor I am given a tablet computer which can be used to enhance the way I give presentations to the students.

When developing my courses here at UOIT I have been able to use this laptop program to enhance my teaching in some of the following ways.

Technology in Lectures

One of the most evident differences between traditional teaching styles and teaching with technology is the lecture format. At UOIT I have been working on developing a teaching style that balances relaying information to students and ensuring that the students are using some active learning techniques to keep their attention on the lecture while making use of the technology that is available to us here. Over time I have discovered that if I prepare a PowerPoint slide with everything already written in it, the students would only sit passively and in this situation they have a short attention span and then their minds start wandering and they do not pay attention. Conversely, if I come with a blank page and write down all of my material the students are not able to keep up and they cannot focus on learning the information which I am trying to present to them. In order to keep the students attention, it is critical to ensure that they are actively engaged in the lecture – sometimes simply by writing notes and sometimes through other participation.

Part of my presentation style is to use PowerPoints that have been prepared with partial information for my lecture. I lecture from these PowerPoint slides but use the tablet functionality of my computer in order to mark up these PowerPoints. Typically the new information that I want to present to my students is

"developed" in front of them with the tablet, but I do not have to waste time setting up tables or charts or problem statements as these would be in the original PowerPoint slide. There are three great advantages to this system – (1) with the blank slides, as a teacher I am kept on track because each of my topics has a page with partial information that is devoted to that topic, so I have a framework to work from, (2) with the marked up slides I have a record of everything I have written for the students and (3) that the information is presented in a reasonably neat way and I do not have to rely on my handwriting – if there is a longer definition or problem statement I can have it prepared in the PowerPoint slide, but if there are equations to develop or tables to fill out I can do this in front of my students so that they are able to follow the train of thought and the reasoning so that they themselves are able to solve similar problem by mimicking the method that was demonstrated to them.

The slides that I prepare are made available to the students in advance of the lecture so that students are able to come to the lecture with printed blank slides if they would like. I typically do not post the marked up slides immediately after lectures as I would like to ensure that students are still taking notes and that they do not rely entirely on my notes. Instead, I make the marked up slides available to students in my office if they would like to see them again or reference any of that material during the semester. Although I don't usually post slides immediately after my lectures, I will often post some of the marked up slides prior to testing so that students do have a reference to go back to if they missed anything. Examples of these marked up slides can be found in later in this section under the samples of undergraduate course material in 4.f.i.

As part of my professional development in teaching, I have taken a course where I learned how to use Camtasia, which is software which creates audio-visual presentations by combining a video of streamed screenshots of the computer with audio which can be recorded in real time. I have used Camtasia in my Modern Control Systems Course to record lectures and make them available to students in this manner – as well as using Camtasia to provide some extra tutorial style help in areas that the students are having trouble with.

Pop-Quizzes

As part of my attempt to keep students engaged, when classroom sizes permit, I use pop-quizzes in my lectures to promote thought and discussion. (Students are made aware in the beginning of the semester that they will be graded on attendance through the use of these pop-quizzes.) I use the technology available to me in Blackboard so that my pop-quizzes are done online when material is simpler. In order to help ensure that only students who are in the lecture write the pop-quizzes I set a password on these quizzes which I announce at the commencement of the quiz. This technology is a great enhancement to the teaching experience because I am able to quickly see how much the class understood without the cumbersome task of individually grading an extra set of paper quizzes.

In Class Demos

In ELEE3100, a large component of the analysis and design of controllers can be achieved using MathWorks' Matlab software. In my lectures I emphasize to students both the need to understand how to solve problems by hand and the need to understand how to both use Matlab to solve their problems and how to understand the output that Matlab gives them when they solve their problems. Knowing that Matlab is readily available to all of my students I am able to teach my students how to use this technology tool in conjunction with my course. I do this in three ways: (1) In my lecture slides I make sure to always have a slide which lists the relevant Matlab commands so that the students are aware of how to use the

software to solve their problems, (2) I incorporate the plots which Matlab outputs into my lecture slides, and (3) I do in class demos of solutions to problems using Matlab. In these demos I will open the software in front of the students and work through the steps involved in solving the problem. I will then show the graphical outputs to the students and highlight the relevant features as well as teaching students how to look for the important parts of the results in these graphs.

In addition to teaching students how to use Matlab to their advantage in Control Design, I also created a set of Matlab functions which help students through the learning process by solving problems in a manner which mimics hand design – thus helping them learn how to connect the theory that they study with realistic implementation.

Design in the Classroom

In both ENGR4100 and ENGR2450 there is a large design component to the course. Whenever I teach a course which is heavily impacted on design I try to ensure that I cover the new material taught in the first 9-10 weeks of a 12 week semester so that I have 2-3 weeks available to practice intensive design with the students. During these three weeks I use a framework of blank presentation slides with headers only and for each class we interactively work through a design problem. In the first "design" lecture I go through the steps of an axiomatic approach to design with the students after which I use pre-set slides to design a solution to that problem. This first design lecture uses the typical lecture format. After this, I utilize the laptop technology in two ways that impact the design portion of the course. First, I use online tools to have the students submit their own suggestions for "design problems" that can be solved in class. I then allow for student participation in the following lectures. I have students come up in groups to solve one of the design problems that their peers suggested. (If the suggestions are not completely relevant then I will adjust a problem or give them one of my own.) The students who are selected demonstrate to the class how they would go about solving the design problem. The students use my tablet to illustrate to the class how they would attempt the design. The student designs are then posted onto Blackboard so that they are available to the class.

Online Assignments

Using Blackboard I also have given non-traditional assignments. The Blackboard assignments can be timed, so when I gave these assignments I told students to treat the assignment like a test, to study their material so that they are up to date with the lectures, then to attempt the assignments. In order to give them a better chance of succeeding they were allowed to try these online assignments multiple times and were also told that they could work with their peers, but that they should ensure that they understand how to solve all of the questions if they choose to work in groups. Students who use this properly are being given a chance to test their knowledge in an alternate way. Assignments were typically given a three hour time limit in Blackboard, thus students would have enough time to look up any information that they did not remember.

Testing with a technology component

In ELEE3100 I emphasized the importance of design both by had drawn approximation methods and through the use of Matlab. I used two ways in which to test the students understanding of the Matlab: (1) for the topic of time responses I included Matlab figures in my tests and in a multiple choice question I asked students to identify the systems that created these responses. (2) I also creatively incorporated Matlab analysis and design into their testing - for their midterm a portion of the grades was assigned to a

24 hour take home component which they received in their in class midterm. As well, they had a take home bonus question in their final exam.

Discussion Threads

For most of my courses I set up the discussion tool in Blackboard. I suggest to my students that they can use this thread of online postings to ask their peers questions and to try to help each other. I tell them that if they want to ask me a question they should send me an email, but if they want to poll their classmates and get help from their peers they can use the discussion thread. (I do monitor these discussions, and if there are questions that they have from me I either post an announcement or address the questions to the class in the beginning of the next lecture, depending on what is most appropriate.) Using the tool in this ways gives me a chance to know what the students are having trouble with.

Laboratory Work

In any engineering degree lab work is used to give the students hands on experience. At UOIT we have the advantage that the students will already have the software which must be used in their labs already installed on their own personal UOIT issued computers. I utilize the availability of the technology to students when I structure my labs. I encourage students to prepare the parts of the lab that they are able to in advance on their laptops and use the in lab time more constructively to simply test and debug their labs.

Anonymous Surveys

I try to elicit useful feedback from my students by creating anonymous surveys through Blackboard. These surveys will ask the students to comment on different aspects of the course so that I can get some constructive and useful feedback without putting any of the students on the spot.

C. Self-Evaluation of Teaching and Student Learning

I believe that overall I have been successful at teaching, and that my students have been successful in their learning process. Often, my students work hard during the term and they can be frustrated by my style of testing after their first midterm. Typically they work to overcome this and eventually succeed. This is something the students don't always understand and appreciate at the time, and I believe it has at times led me to have lower standardized teaching evaluation results. Despite this difficult time for the students during the term, and despite sometimes lower teaching evaluations, I believe I have met with general success. I often have students coming to thank me the following year. I have heard them tell me many times that my course helped them learn how to think and that the skills they gained are invaluable. The reward of having a student who has matured come by to thank me a year later makes all the extra help hours and all the extra work I have put into teaching worth it. I love knowing that I have made a difference to the students and that I have been able to make an impact on their lives.

Pop Quizzes Vs. Homework

The strategy of giving students pop-quizzes in class has had some mixed results. Although I do think that giving students a chance to evaluate their knowledge and incentive to keep up to date in their material is important, unfortunately the time available in a 12 week semester is critically limited and I think that

giving pop-quizzes sometimes takes away from valuable teaching time. In order to try to maintain the benefits and minimize the time lost from teaching, this past semester I have moved more towards a homework model, where I give students the same problem as a homework problem, leaving them with the knowledge that this will likely form part of their future testing. The disadvantage to this is that often the students who need the practice most do not do the homework as it is not mandatory and not collected. Unfortunately, with limited resources there is not good solution to that issue. Both models have advantages and disadvantages and I continue to strive towards finding the best balance.

Teaching with Design Examples

One of the things that I find challenging is finding enough time to cover examples that are both complex enough to highlight the application of knowledge and yet simple enough to illustrate how the techniques which are taught work. I find that when teaching a concept for the first time simple examples are needed, yet when applying knowledge to larger design problems, there often isn't enough time to get enough good examples into the lectures. This is particularly the case in the Modern Control Systems course where material can get used in quite challenging ways. In order to help students with this challenge,

Software Simulation vs. the Application of Theory

With the push for technology students sometimes fail to connect hand computation and theory to parallel computer simulation and results. Learning the intuition which can guides this understanding is often a matter of practice which students sometimes fail to realize. As part of my teaching I try to emphasize this and to force students to put in that practice through guided testing. As an example of this, for the Modern Control Systems course I test them on the identification of Matlab plots for step responses. Often they don't realize that they need to put in the time to practice this in Matlab prior to their midterm. I always give them a second chance on this in their final exam and I have typically seen a noticeable improvement at that point. I have also programmed a Matlab tool for students to use to help guide them through later homework/problems in this course with great success.

Technology in the Classroom

When I joined UOIT there was a strong emphasis on applying as much technology as possible to lectures and teaching. Through my years at UOIT there has actually been some backing off from this philosophy. I think that active learning is more critical in the classroom than the use of too much technology. For example, I have found that PowerPoint lectures on their own can leave students behind as it is too passive, and only through the addition of using a tablet to write onto lectures does the active learning come back into that process. I find that I am working to maintain a balance of technology vs. an expectation of note-taking from the students. I believe that overall I have been successful in finding a reasonable balance. Similarly, with demonstrations using software, I have found these are most effective when combined with an expectation that students must complete homework or projects where they need to actively mimic or repeat what was done in the demonstrations. Generally, balancing the use of technology in the classroom with other active learning strategies has been successful.

Design Project

In the second year Digital Systems course I have always had the students work through a design project, but I had found very mixed results with respect to quality of the work from the students. In the past this

project was individual work, and required students to do a design and a simulation but not to build their project. This past year I redesigned the project to be a group project in which students were expected to build a part of their design and at the end of the semester there was a demonstration day. The strategies behind the redesigned project were extremely successful and I was quite impressed with the creativity and resulting projects built by the students.

Testing Strategies

This is one of the areas which I find most challenging. I find that I am always fighting to find a good balance between testing knowledge and testing the ability to apply that knowledge. I have had both successes and failures with this. The biggest difficulty comes from students who are resistant to learning to apply knowledge as they have become accustomed through high school only needing to regurgitate the facts and methods they were taught. I find that the higher the year a student is in, the better they are with applying their knowledge. Despite the difficulties with this, I believe I am succeeding overall as students have often come to my office a year or two after a course and told me that I had challenged them to learn to think, that mine was one of the few courses that did so, and that this skill has helped them with future courses.

General Challenges Encountered

I have found that sometimes our engineering students have been weaker in their background than they should have been and this has posed challenges. I believe that students are being allowed to coast through first year in the service courses and when those students should not have been accepted into an engineering program in the first place due to a lack of skills or extremely low entrance averages, allowing them to get through first year without gaining those skills is detrimental to the program. Thankfully, through my years at UOIT I feel that this situation is definitely improving overall.

D. Professional Development of Teaching/Learning

The following is a list of professional development of teaching/learning courses and workshops which I have taken since starting my career at UOIT. These courses were taken in order to help me improve both my teaching and my use of technology in the classroom.

2014 Teaching Squares Program

I participated in this UOIT teaching squares program over the Winter 2014 semester. The program ran a series of lectures/workshops on successful teaching strategies. As part of the program, participants were grouped together and we had the opportunity of having our lectures evaluated and critiqued and of evaluating and critiquing fellow colleagues lectures.

2014 Turn-It-In Seminar

In order to help ensue the quality of student work and be certain that I could efficiently check on student project which were submitted to me, I took a one-on-one workshop on how to use the Turn-It-In with Blackboard.

2013 Blackboard Seminar

I participated in a UOIT seminar on how to use Blackboard efficiently. I sought out this workshop since I was unfamiliar with Blackboard when I returned from leave and I wanted to ensure that I would be successful in reaching students with this tool that was new to me.

2009 *Camtasia Workshop*

This workshop is an introduction into how to use Camtasia in order to produce online lecture materials which can be reviewed by students at their discretion. Camtasia allows a professor to develop audio-visual presentations by recording screenshots while including audio. This type of presentation mimics the material which a student is able to see in a standard lecture, while allowing a student the chance to view that lecture more than once if there were any concepts that were not fully understood the first time.

2009 *Leaders in Teaching and Learning Series – Dr. Gosha*

This was a two hour workshop which focussed on how to structure a lecture in such a way as to keep the students engaged in the course. Dr. Gosha presented some ideas on how to include some active participation from the students as well as how to keep their attention in class.

2009 Engineering a Successful Teaching Experience

This was a wonderful 3 day intensive workshop given at the University of Toronto. The workshop focused on how to keep students engaged in the classroom as well as how to identify different learning styles and make use of those learning styles to maximize the students ability to learn and retain information from a lecture.

2009 *MATLAB workshop*

This was a full day series of lectures given by Mathworks at UOIT in order to help teach users of Matlab how to utilize a greater spectrum of functionality and optimize the performance of computations done using Matlab. This was of interest to me both from a teaching and a research perspective. It was useful towards teaching since my ENGR4100/3100 course emphasises the use of Matlab as an analysis and design tool.

2008 *Student Assessment Using Blackboard – Workshop*

This was a hands on workshop given by the learning and innovation centre at UOIT geared towards using Respondus and Blackboard to create online assignments and grading forms.

2007 *Engaging Students in Active Learning – Workshop*

This was a wonderful half day workshop put on by the innovation centre at UOIT where university and college faculty were taught about the concepts of active learning and how to find alternate ways to motivate students and keep them actively involved in the learning process.

2007 *General Blackboard Workshop*

This was an introductory half day workshop which showed some of the basics of how to use Blackboard and how to set up a course with all of the relevant tools and utilities. This was particularly useful for new faculty who have not been previously exposed to Blackboard.

2007 *Faculty Career Development Workshop*

This was an afternoon workshop which helped explain to new faculty what the different stages of a faculty career are. The workshop went through the milestones and structure of a tenure track appointment and helped explore what may be expected at each of these milestones. Part of this workshop included a session on teaching ideas and strategies.

Section 2:

Teaching Responsibilities and Contributions

In my time at UOIT I have always taught a full load of courses, except when on sick or maternity leaves. (In fact, upon return from maternity leave in the fall of 2013, despite having a collective agreement, in which professors should be teaching for only two consecutive terms, I actually was given a teaching load of four consecutive terms between Winter 2014 through Winter 2015.) I greatly enjoy my teaching responsibilities. I find it very rewarding to teach and mentor students. In particular, I love helping students to grasp a new concept and learn to apply it to engineering design. I always make sure that my students know that my door is always open to helping them, whether it is during the term of the courses I am teaching them, or even afterwards. I do my best to mentor students while teaching them. I believe that everything we do as teachers impacts on how students are molded and as such it is critical to be a good role model to the students in every aspect.

I have contributed to the design and development of seven different courses while at UOIT. Four of these are undergraduate courses and three of these are graduate courses.

A. Courses Taught

The complete list of teaching loads, found below, indicates which courses I taught in each semester as well as how many students were in each of these courses. Following this, I give more detailed information about the courses and my role in designing and developing these courses. Although I give some details about the course material, this is not given in depth here. More information on the detailed course material is included in Appendix A, which contains the most recent course outline for each of these courses.

List of All Teaching Loads by Term at UOIT

Upcoming Teaching Load for 2016-17

Winter 2017

Modern Control Systems **ELEE3100**
- Approx. 80 students expected in the course

Digital Systems **ELEE2450**
- *Co-ordination of course and teaching of 2 sections*
- Approx. 150 students expected in the course

Capstone Supervision - 2 group projects
- 2 group project with a total of 8 expected students

Fall 2016

Capstone Supervision - 2 group projects
- 2 group project with a total of 8 expected students

Teaching Loads from Fall 2008 – Summer 2016

Spring/Summer 2016	*no courses taught – research term*
Winter 2016	**Digital Systems** **ELEE2450** • *Co-ordination of course and teaching of 2 sections* • Undergraduate course with 138 students **Capstone Supervision** • 2 group project with a total of 8 students
Fall 2015	**Classical Optimization** **ENGR5010** • Graduate course with 20 students **Capstone Supervision** • 2 group project with a total of 8 students
Spring/Summer 2015	*no courses taught – research term*
Winter 2015	**Modern Control Systems** **ELEE3100** • Undergraduate course with 72 students **Digital Systems** **ELEE2450** • Undergraduate course with 121 students **Capstone Supervision** • 3 group project with a total of 10 students
Fall 2014	**Classical Optimization** **ENGR5010** • Graduate course with 26 students **Directed Studies – Optimization** **ENGR6004** • One on one course with my Ph.D. student **Capstone Supervision** • 3 group project with a total of 10 students
Spring/Summer 2014	**Special Topics in Adaptive Control Systems** **ENGR5930** • Graduate course with 6 students
Winter 2014	**Modern Control Systems** **ELEE3100** • Undergraduate course with 54 students **Digital Systems** **ELEE2450** • Undergraduate course with 125 students
Fall 2013	*no courses taught - return from maternity leave mid-semester*
Spring/Summer 2013	*maternity leave*
Winter 2013	*maternity leave*
Fall 2012	*maternity leave starting mid-semester*
Spring/Summer 2012	no courses taught – research term
Winter 2012	*return from maternity leave mid-semester*

Fall 2011	*maternity leave*
Spring/Summer 2011	*maternity leave*
Winter 2011	*short term disability leave followed by maternity leave*
Fall 2010	*short term disability leave*
Spring/Summer 2010	*no courses taught – research term*
Winter 2010	**Modern Control Systems** **ENGR3100/ENGR4100** • Undergraduate course with 58 students **Digital Systems** **ENGR2450** • Undergraduate course with 74 students **Directed Studies – Discrete Time Control** **ENGR5004** • One on one course with my M.A.Sc. student **Directed Studies – Optimization Controls** **ENGR5004** • One on one course with my M.A.Sc. student **Capstone Supervision** • 2 group project with a total of 8 students
Fall 2009	**Special Topics in Adaptive Control Systems** **ENGR5930** • Graduate course with 14 students **Capstone Supervision** • 2 group project with a total of 8 students
Spring/Summer 2009	*no courses taught – research term*
Winter 2009	**Modern Control Systems** **ENGR4100** • Undergraduate course with 19 students **Digital Systems** **ENGR2450** • Undergraduate course with 51 students **Capstone Supervision** • 2 group project with a total of 5 students
Fall 2008	**Nonlinear Control Systems** **ENGR5920** • Graduate course with 3 students **Discrete Mathematics** **ENGR2100/CSCI2110/MATH2080** • Undergraduate course with 103 students **Capstone Supervision** • 2 group project with a total of 5 students
Spring/Summer 2008	*no courses taught – research term*
Winter 2008	**Digital Systems** **ENGR2450** • Undergraduate course with 48 students **Probability** **ENGR3070** • Undergraduate course with 32 students **Thesis Supervision** • 4 students doing 4 individual projects
Fall 2007	**Discrete Mathematics** **ENGR2100/CSCI2110/MATH2080** • Undergraduate course with 96 students

Detailed Information on Individual Courses Taught

The following section contains detailed information about the courses I have designed, developed and taught at UOIT.

Undergraduate courses taught:

Modern Control Systems - ELEE3100/ENGR3100/ENGR4100 Winter 2014-15, 2009-10

Modern Control Systems is an introductory course to the field of control systems. I designed and developed this course for the first cohort of Electrical Engineering students at UOIT and taught it for my several years at UOIT until I had to go on short term disability leave. Since return from maternity leave in 2013 I have updated and taught the course again. The course focuses on the tools used for design and analysis of linear control systems. Students learn how to apply tools such as root locus, Routh Array, Bode plots and Nyquist plots in order to analyse systems and design controllers that can successfully stabilize a system. The course relies heavily on a knowledge base that is built in introductory systems and signals courses. At most universities it is taught as a fourth year fall course, allowing for a spring elective in the control systems area. At UOIT this course was introduced as a fourth spring year course. Because capstone projects ,which rely on a knowledge of control systems, benefit from having this course earlier, the course was moved to a third year spring course.

The original labs for the course relied on a lab kit purchased from Quanser Electronics which allowed for various aspects of servo-motor control. These labs matched up with labs in a similar course in Mechanical Engineering. Upon my return from maternity leave in the fall of 2013, I lobbied to purchase new lab equipment as these labs were not ideal for the course, but with limited funds it was difficult to purchase better lab kits. As a result, in the fall of 2013, when it became apparent that there were no funds to get more appropriate lab equipment, I redesigned half of the labs in the course using simple electric circuit components. The new labs allow for students to "build" transfer functions, in order to help them visualize what a control system is all about. They gradually expand what they build, allowing them to visualize impulse and step responses of a transfer function by running these through their circuits.

Digital Systems - ELEE2450/ENGR2450 Winter 2014-16, 2008-10

Digital Systems is an introductory course in digital system design. I did a major re-design this course for UOIT and taught it for the first several years until I had to go on short term disability leave. Since return from maternity leave in 2013 I have updated and taught the course again. The course is a follow up course to Discrete Mathematics, where digital logic is used to analyse and design real digital systems. Students learn to design both combinational and sequential circuits, using standard components including AND/NAND/OR/NOR/XOR/XNOR/NOT gates as well as D latches and D and JK flip flops. They learn how to use tools such as Boolean Algebra simplification, Karnaugh mapping as well as finite state machine design. Students also learn how to use Base 2^n numbering systems and how these are practically applied to computer design. I always emphasize the design component of this course to the students. As future engineers, design aspects are important and learning how to apply design within their work allows them to develop critical skills.

The original projects in this course were individual design projects in which students designed and simulated a digital system of their choice. This did not allow for building the system as it was too much of a load for individual students to also build a system. In the fall of 2014 I redesigned the project for this course to allow for group projects and by doing so I was able to incorporate building the digital system into

the project. At the end of the course students had a demonstration day where all groups bring their projects in and they both get to explain to their peers what they have done, as well as to view their peers projects. This addition greatly benefitted the students as it helped to contextualize what can be done in digital system design.

Discrete Mathematics - ENGR2110/CSCI2110/MATH2080 Fall 2007-2008

Discrete Mathematics is an introductory course in mathematical logic. This course used to be cross listed and taught to students amongst three different faculties, with the majority of students belonging to the Electrical and Software engineering programs. The course was originally taught in the computer science department and when I took it over in the fall of 2007 I redesigned the course to make it more applicable to the engineering students. Since this course is primarily a mathematics theory course, there are no labs in this course. I taught Discrete Mathematics for several years, but when the electrical cohort went into it's fourth year I stopped teaching this course in order to allow me to design, develop and teach the Modern Control Systems course.

Probability and Random Signals - ENGR3070 Winter 2008

Probability and Random Signals is an introductory course in probability theory. This course goes hand in hand with Systems and Signals, teaching the more theoretical aspects of probability and allowing students to also gain knowledge about random signals which apply towards Systems and Signals which they take at the same time, as well as Communications Systems which they follow up with. The course relies heavily material taught in the Calculus III course. I designed and developed this course in my first year at UOIT and taught it that year to the first cohort of electrical engineering students who were in their third year at the time. Though I developed and designed the course, I only taught this course once as I was given the opportunity to teach both a graduate course in my research area as well as Modern Control Systems in the following year.

Graduate courses taught:

Classical Optimization - ENGR5010 Fall 2014-2015

Classical Optimization is a graduate course which focuses on optimization, using classical techniques, primarily using convex optimization schemes. I took over this course for two years while the professor who normally teaches it was on leave. Though the graduate calendar lists classical optimization techniques for this course, the professor who normally teaches it does not follow this and teaches primarily metaheuristic techniques. I felt it was important for students to have a course which followed the basic course outline in the graduate calendar, so for this reason, when I taught the course, I actually had to develop the course from scratch.

Special Topics in Adaptive Control Systems - ENGR5930 Fall 2009, Spring 2014

Adaptive Control Systems is a graduate course which introduces students to methods of adaptive control, for both linear and nonlinear systems. Due to the limited number of graduate courses which are offered in the control theory area at UOIT, the course, by necessity, spends several weeks introducing students to methods for practical analysis of control systems using both theoretical means and using Matlab to find system characteristics using simulation. I then teach them some fundamental basic methods of adaptive control design. I use the first 8 weeks of the course to teach them the basic background and basic adaptive control techniques, then I allow students to direct the methods taught in the last 4 weeks based

on their research applications and needs. Doing this does create more work for me, but it allows the course to be more applicable for the students. This teaching method follows from my philosophies on graduate student teaching.

I developed and designed this course to attract a multidisciplinary group of students at UOIT. This is somewhat of a challenge since students in various areas of study have extremely diverse mathematical and engineering backgrounds, yet it is important for the material to be reachable by all of these students. The course was extremely successful and it was quite impressive to see graduate students in a very diverse set of areas applying adaptive control systems to problems in their fields of study.

Analysis and Control of Nonlinear Systems - ENGR5920 Fall 2008

Analysis and Control of Nonlinear Systems is a graduate course which introduces students to the fundamental principles of nonlinear control theory. Again, due to the limited number of graduate courses which are offered in the control theory area at UOIT, the course, by necessity, spends several weeks introducing students to methods for practical analysis of control systems using both theoretical means and using Matlab to find system characteristics using simulation. The course is structured in a manner similar to the adaptive control systems course, where I then teach them some fundamental basic techniques for nonlinear stability analysis and nonlinear controller design. I use the first 8 weeks of the course to teach them the basic background and basic nonlinear controller analysis and design techniques, then I allow students to direct the methods taught in the last 4 weeks based on their research applications and needs. I find this is an extremely successful graduate course model.

Graduate directed studies courses taught:

Directed Studies – Optimization - ENGR6004 Fall 2014

This course was designed for Timothy Teatro, a Ph.D. student whose doctoral research is on the application of nonlinear model predictive control to a telepresence health robot. This course was a higher level course on the mathematics behind optimal control theory, designed to fill in some mathematical and theoretical background in theoretical optimal control theory. The course focused on classical optimal control, including Hamiltonian methods, the Maximum Principle, KKT conditions on optimality and dual space methods.

Directed Studies – Optimization Controls - ENGR5004 Fall 2010

This course was designed for Harris Chowdhry, a M.A.Sc. student whose research was on the application of linear model predictive control to a path-planning problem with state space constraints. This course was an introductory level course on practical methods in optimal control theory and focused largely on linear model predictive control methodologies, including the theoretical application of quadratic programming to systems with state and input constraints.

Directed Studies – Discrete Time Control - ENGR5004 Fall 2010

This course was designed for Mariam Fatima, a M.A.Sc. student whose research was on the application of discrete time control to a special fixture, which provides 5 DOF capabilities for a 3DOF CNC mill. The purpose of the fixture is to allow for a specialized manufacturing process called Single Point Incremental Forming (SPIF). In order to achieve this, the fixture was treated as a robotic manipulator and this course was an introductory course on robot path planning and discrete time control systems which could be used to control robotic manipulators.

Courses Taught at U of T prior to commencing my position at UOIT

2006 Dept. of Mathematics, University of Toronto
Lecturer, Calculus I (MAT 188 F)
This was a course taught to engineering students only.

2000 Dept. of Mathematics, University of Toronto
Lecturer, Linear Algebra (MAT 198 F)
This was a course taught to engineering students only.

B. Supervision

I have always found supervising and mentoring students extremely rewarding. I have supervised 6 graduate students and over 40 undergraduate students during my time at UOIT. In addition, I have 3 incoming graduate Masters students whom I have accepted for the 2016-17 year as well as 2 groups (8 or 9 students) of capstone students. This section of my teaching dossier lists all students whom I have supervised, together with the projects which they have worked on.

Graduate Supervision

Doctoral Students:

Sept. 2013 – present Timothy Teato *(degree in progress)*
Ph.D. candidate in Electrical Engineering
Thesis Topic: Nonlinear Model Predictive Control
Joint primary supervision together with Prof. Mikael Eklund

Timothy Teatro has been working on various aspects of NMPC, including both theoretical contributions to NMPC and path planning as well as practical contributions to implementation of an NMPC controller on a VirtualME robot. This omni-directional holonomic robot was designed and built by CrossWing Inc. for the health informatics sector. Mr. Teatro has made multiple contributions to the control of the robot. In addition to his direct contributions to NMPC, he has also contributed to the field by developing a novel software platform for the implementation of NMPC control on real systems. Mr. Teatro's research and dissertation have progressed nicely and he is anticipated to complete his degree towards the end of this coming year.

Master's Students:

Sept. 2012 – Aug 2013 Timothy Teato *(moved to Ph.D. program)*
M.A.Sc. candidate in Electrical Engineering
Thesis Topic: Nonlinear Model Predictive Control applied to a VirtualMe Robot
Joint primary supervision together with Prof. Mikael Eklund

Timothy Teatro spent one year in the masters program then converted his degree to a Ph.D. Information on his research is listed above.

May 2009 – Nov 2012 Mariam Fatima *(graduated 2012)*
M.A.Sc. completed in Electrical Engineering
Thesis topic: Control of a machine for SPIF sheet metal forming
Joint primary supervision together with Prof. Marnie Ham

Mariam Fatima did her masters research in a multidisciplinary area, applying knowledge of control systems to a mechanical engineering problem in the area of sheet metal forming. A specialized fixture was used for the purpose of single point incremental forming (SPIF). Ms. Fatima showed the equivalence of the fixture to a robotic manipulator and used path planning concepts to generate toolpaths and motion control for the fixture. After graduating from her masters degree Ms. Fatima got a senior control engineering position in industry.

Sept. 2011-March 2012 Muhammad Awais Abbas *(graduated 2012)*
M.A.Sc. completed in Electrical Engineering
Thesis topic: Nonlinear Model Predictive Control Applied to a Vehicle Path Planning
Joint primary supervision together with Prof. Mikael Eklund

Muhammad Abbas did his masters research in the application of a path planning NMPC controller to vehicle path planning in an environment with constraints. He used motion based vehicle simulator software to simulate an autonomous vehicle travelling on a road with occasional obstacles which would force the vehicle to do lane manoeuvres. After graduating from his masters degree, Mr. Abbas got a senior control engineering position in industry.

Sept. 2010-Aug. 2011 Jonathan Hodgkins *(graduated 2012)*
M.A.Sc. candidate in Mechanical Engineering
Joint supervision together with Prof. Dan Zang

Jonathan Hodgkins did his masters research on the control of a robotic manipulator. Mr. Hodgkins commenced his degree just after I had been injured in a car accident so I only supervised him for one year of his degree, after which he continued under the sole supervision of Prof. Dan Zang.

Sept. 2009-Dec. 2010 Harris Chowdhry *(graduated 2010)*
M.A.Sc. completed in Electrical Engineering
Thesis topic: Model predictive control strategies
Sole supervision

Haris Chowdhry did his masters reseach on pathplanning and control of dynamical system using constrained LMPC strategies. He applied an algorithm which I had developed to the control of a bicycle model vehicle, implementing innovative ideas for an extension of the work with state constraints. After graduating from his masters degree, Mr. Chowdhry continued his graduate studies in Nuclear Engineering with Prof. Hossam Gabar. Mr. Chowdhry then proceeded to obtain a senior control engineering position in industry.

Jan. 2009 – Jan. 2010 Gabriel Alcantara (*left graduate program)*
M.A.Sc. candidate in Mechanical Engineering
Thesis topic: Control of Automotive systems
Joint primary supervision together with Prof. Greg Rohrauer

Gabriel Alcantara began his masters research in control of automotive systems and battery management. He was an international student and found the combination of language barriers and living in Canada challenging thus chose not to continue his studies after a few semesters.

Incoming Master's Students

Sept. 2016 Sathepan Nagendrarajah *(starting Sept. 2016)*
Thesis Topic: Path-planning and Control of an Autonomous Vehicle
Sole Supervision

Sept. 2016 Taylor Egan *(starting Sept. 2016)*
Thesis Topic: TBD
Joint Supervision with Prof. Hossam Gaber

Jan. 2017 Ansanul Hoque *(starting Jan. 2017)*
Thesis Topic: TBD
Sole Supervision

Other Graduate Level Project Supervision

Sept. 2014-Jan. 2015 Benjamin Wilk
Project Topic: Programming of a Simulation Framework for the VirtualME Robot
Joint primary supervision with Timothy Teatro

Benjamin Wilk worked on a project related to an NSERC Engage grant, where he programmed/coded a software solution to the implementation of an NMPC controller for the VirtualME robot. He worked together with Mr. Timothy Teatro, writing the code for some of the research solutions that Mr. Teatro had worked out for the robot. This was a short term project whose purpose was to further industrially collaborative research with CrossWing related to the VirtualME robot.

Oct.-Dec. 2014 Janamejaya Channegowda
Project Topic: Updating labs for ELEE3100
Sole Supervision

Janamejaya Channegowda worked on a project to develop new labs for the ELEE3100 modern control systems course. The new labs used simple circuit components to "build" first and second order transfer functions, thereby implementing a physical system that could be tested for impulse, step and ramp responses. Under my direction he tested experiments which I had devised for the course, coming up with reasonable circuit

component values and putting together both student lab manuals as well as solution manuals for these labs.

Undergraduate Supervision

Undergraduate Thesis/Capstone Projects:

The fourth year capstone project or thesis is a special design course where students apply a combination of the technical skills which they have gained in their first three years with research and design skills in order to solve a large scale problem. Each project is developed in order to apply these design skills to a relevant problem or application. Mentoring and supervising students in their capstone projects has always been rewarding so I have strived to maintain this student contact in all of my years at UOIT. As there is a long list of projects which I have supervised, I have not given details on each project, rather I have only given a succinct project description for each of these. Each of these student groups were successful in achieving the goals of their respective projects. Most of these students are now working successfully as Electrical Engineers in relevant and important industrial jobs.

The vast majority of the capstone projects which I have supervised have come from project proposals that I myself have put forward. As well, two of the four thesis project which I supervised also came from project proposals that I myself put forward. All of these project proposals came from ideas and goals which stem in some way from my research.

Sept. 2015 - May 2016 Yazeed Al-jedaibi, Sabah Hanna, Omar Shoukat, Muhammad Umar
Capstone project: ABSK - Automatic Self Braking Kit
B.A.Sc. candidates in Electrical Engineering
Sole Supervision

Sept. 2015 - May 2016 Shoaib Akhtar, Farooq Hyder, Rashid Mahmood, Muhammad Sheikh
Capstone project: Overhead Distribution Line Monitoring Drone
B.A.Sc. candidates in Electrical Engineering
Sole Supervision

Sept. 2014 - May 2015 D'Andrade Browne, Mustafa Malik, Jeffrey Omovie, Ahmad Shamshiri
Capstone project: Position Aware Airborne Vehicle
B.A.Sc. candidates in Electrical Engineering
Sole Supervision

Sept. 2014 - May 2015 Andrei Bandoc, Robert-Nikola Dejanovic, Larry Hocken, Raymond Papa
Capstone project: Visualar – Visual System for 3D room mapping, object localization and object recognition
B.A.Sc. candidates in Electrical Engineering
Sole Supervision

Sept. 2014 - May 2015 Bryce Benn and Sarim Mahmood
Capstone project: Obstacle Detection for the VirtualME telepresence robot.
B.A.Sc. candidates in Electrical Engineering
Joint primary supervision with Prof. Ying Wang

Sept. 2009 – May 2010 Mohshina Chowdhury, Ira Gupta, Joseph Horobetz
Capstone project: Design of an Inverted Pendulum Lab Setup
B.A.Sc. candidates in Electrical Engineering
Sole supervision

Sept. 2009 – May 2010 Fahim Faqirzai, Kenosi Katjipaha, Chris Mansell, Neujan Muthiah, Chasiwa Omphemetse, Blessing Sebinyane
Capstone project: Enable Project - Design of a Sling Arm for Handicapped Person Pool Entry
B.A.Sc. candidates in Mechanical Engineering
Joint supervision with Prof. Marnie Ham

Sept. 2008 – May 2009 Anton Gavrilov and James Forde
Capstone project: Lidar Navigation
B.A.Sc. candidates in Electrical Engineering
Sole supervision

Sept. 2008 – May 2009 Kemunto Mochama, Mansi Modi and Shirva Wells
Capstone project: Development of an automotive controller as part of an EcoCar project
B.A.Sc. candidates in Electrical Engineering
Joint primary supervision with Prof. Mikael Eklund

Jan.-May 2008 Peter Budd
B.A.Sc. candidate in Mechanical Engineering
Thesis topic: Modular design of a computer remote control interface for a 3DOF helicopter.
Sole supervision

Jan.-May 2008 Davin Gibson
B.A.Sc. candidate in Mechanical Engineering
Thesis topic: Implementation of a computer interface for a remote control toy helicopter.
Sole supervision

Jan.-May 2008 Ian Spencer
B.A.Sc. candidate in Mechanical Engineering
Thesis topic: Design and development of an actuation and sensory system for a two wheeled electric vehicle.
Joint primary supervision together with Prof. Mikael Eklund

Jan.-May 2008 Calvin Soenjaya
B.A.Sc. candidate in Mechanical Engineering
Thesis topic: Remote control of a two wheeled vehicle with stabilizing landing gear.
Joint primary supervision together with Prof. Mikael Eklund

Undergraduate Summer Project Supervision:

I have had many requests over the years from undergraduate students who would like to spend their summer conducting research. I have tried whenever possible to accommodate these requests as I have found that working with motivated undergraduate students over the summer is a vastly rewarding experience. Unlike capstone students who are juggling a full load of courses while they work on their projects, the summer students are able to devote their time to research, and they often thirst for knowledge that they can gain doing this summer research.

May-Aug. 2016 Samina Rahmanyar *GE Energy Female in Engineering Summer Experience Award*
Research Topic: Data Mining in a Bugzilla database to create automatic reporting of software faults.

May-Aug. 2014 Jaykumar Patel
Research Topic: Implementation of a Stargazer system for robot orientation

May-Aug. 2014 Jonas Fernandes
Research Topic: Reverse-Engineering of a Hobby Grade Remote for Computer Control of an airplaneto allow for autonomous flight

May-Aug. 2010 Robert Greer *UOIT Star Award*
Research Topic: Software design of system for autonomous motion of a small human driven car

May-Aug. 2009 Samantha Hazell *USRA Award*
Research Topic: Implementation of depth analysis using a stereo vision camera

May-Aug. 2008 Kemunto Mochama *USRA Award*
Research Topic: Setup of a Stereo Vision camera

May-Aug. 2008 Mariam Fatima *USRA Award*
Research Topic: Implementation of a Computer Based Radio Control Transmitter

Other Undergraduate Supervision:

May 2008-June 2009 UOIT EcoCAR Team
Project: This team competed in GM's EcoCAR Challenge Competition Design of advanced vehicle technology.
Position: Faculty Advisor
Joint supervision with Prof. Greg Rohauer and Dr. Marnie Ham

C. Teaching Related Contributions

Graduate Student Teaching Contributions

While teaching graduate students I have always focused on not only teaching them the material in my course, but also teaching them skills which they will need as early researchers. In order to help contribute to their education in this way I have a project in which they are expected to apply a strategy or method related to the course material in order to solve a problem that is important in their research areas. I use the conference model of dissemination as the format for their project and as part of this I teach them how to go about putting together research for conference or journal publication. In doing so, I have had two students go the extra mile and we have together taken the research further so that they could actually publish this research. These two publications are listed here:

- Robin McDougall, Ruth Milman, Scott Nokelby, ***A Generic Strategy for Individualized Drug Delivery Including Pharmacokinetic Transport***, *First AMA-IEEE Medical Technology Conference,* Washington DC, March 2010

- Kevin Pope and Ruth Milman, ***Rotor Dynamics Correlation for Maximum Power and Transient Control of Wind Turbines***, *International Journal of Energy Research,* Vol. 34, Issue 8, pp736-742, Dec. 2008

Special Lectures

Another recent contribution which I have made to teaching, is to give a lecture for future female engineering students at UOIT. This type of service opportunity is really about teaching, and I believe that teaching potential applicants what engineering is about is important to our success at UOIT. After my lecture, I was touched and honoured to be told by the staff that this was one of the best such lectures ever given, and asked if I could do this regularly for them.

May 2016	Invited Lecture for UOIT Women In Engineering
Lecture Topic:	***Women in Engineering Through the Ages***

Other Teaching Contributions

I have also contributed in trying to help others with their teaching. I always share my teaching strategies and successes with my colleagues, but in addition, I have done so in a more formal way on occasion,

Winter 2014	Participated in the teaching squares program through the UOIT Teaching and Learning Center – part of this included reviewing the teaching methods of four colleagues.
Aug. 2008	Participated in panel for new faculty orientation – as part of this we shared successful strategies with incoming new faculty members.

D. Curriculum Development

Since joining UOIT, I have both been active in curriculum development and updating curriculum within the courses I teach, as well as participating actively in curriculum development for the ECSE related courses within the faculty.

Development of Curriculum Material within Courses

The general development of curriculum material within the courses I have taught is illustrated within the course outlines for each of the courses that I have taught, which are located in Section 3.A of my Teaching Dossier. Since each course that I taught was either fully developed from scratch or significantly updated and therefore re-developed by me, all of these course outlines are relevant to this.

One area that I would like to highlight within curriculum development is the development of two new labs for the ELEE3100 Modern Control Systems course. I redesigned half of these labs in the fall of 2014, designing completely new experiments for the students in order to give them some hands on lessons on the output response of linear systems to impulse, step and ramp inputs and the impact of moving a system's poles and zeros on these output responses. This modification to and development of the laboratory portion of the curriculum for ELEE3100 is a significant improvement for this course. The newly developed laboratory materials are included in the samples of teaching materials provided in Section 3.B of my Teaching Dossier.

Participation in Service related to Curriculum Development

Since joining UOIT I have been active both in curriculum development for the courses which I have taught and in advocating for appropriate curriculum development within all aspects of our Electrical Engineering Program. I have proactively served and actively participated in many committees related to this as well. Some of my service related to curriculum development includes:

Sept. 2014 - onwards	ECSE- Course Dossier Evaluation Committee	(stream leader)
Sept. 2014 - onwards	ECSE Curriculum Committee	(member)
Nov. 2010 - onwards	ECSE Program Council Committee	(member)
July 2009 - Nov. 2010	ECSE Program Committee	(member)
Sept. 2009 - June 2010	Program Review Committee	(member)
Sept. 2009 - June 2010	ECSE Program Committee	(member)
Jan. - Aug. 2009	Program Review Committee (FEAS)	(member)
April - Sept. 2008	Survey of Math Courses for Engineering students	(organizer)
April - Aug. 2008	Capstone Advisory Committee	

E. Development of Innovative Teaching/Learning Materials

Within my teaching I have always tried to develop new and innovative ways to incorporate some of my goals into my teaching method. Most of these are described in detail in my teaching strategies. There are four specific aspects to my innovative teaching methods/materials this that I would like to point out:

Emphasis on Design in Undergraduate Courses

As part of my teaching philosophy, I believe that since our students aim to be the Engineers of tomorrow, it is our job as FEAS faculty members to prepare them for careers as design engineers. As part of this, in all the undergraduate courses that I teach, I aim to provide a strong design component to the course. In this innovative way, I not only teach the students the tools and methods, but I also teach the students the methodology and skills to apply design to design applications that are relevant to the course material.

Digital Systems Design Project

During this past year I redesigned the project for the digital systems course. As part of the project students must now not only design a digital system, but they must actually work as a team to build at least a part of the design. In order to motivate students to do a good job building their digital system, we devote one lecture to having a student design demonstration day. I have found that this new innovation to my course project has been a huge success and students have truly had a well rounded design experience in this course.

Modern Control Systems Guide to Hand Drawn Design Tools and Software Teaching Tool

Modern control systems teaches students how to use approximations to hand draw solutions for several critical design tools, including Root Locus, Bode and Nyqyuist plots. Students usually have a fair bit of trouble with this ad I often give many extra hours to help students get past their difficulty. Part of the problem that the students face is that there is a pretty big discrepancy between what a hand drawn approximation looks like and what the exact figures, which can be simulated through Matlab, look like. For this reason, one of the innovations that I have added to this course is to program a tool in Matlab which can plot the hand drawn approximations together with the exact simulated figures. This allows students to have a dependable tool which they can use to practice and compare against. Together with this software tool, I have also begun writing a booklet on how to hand draw plots for several critical hand design tools and how to use these tools within the design process. This pair of innovative tools is extremely helpful to students, as they need to learn how to interpret the true Matlab results and understand how to use these together with approximations and rules of thumb to apply the controller design process.

Modern Control Systems Labs

As mentioned in the previous section, in the fall of 2014 I redesigned two of the labs for the ELEE3100 Modern Control Systems course. The new labs form an innovative tool for teaching students about linear system output responses to impulse, step and ramp inputs. Since all students must participate in the labs experiments, this innovative tool ensures that students have hands on experience in evaluating these output responses, giving them a better intuitive understanding of this material within the course.

Graduate Course Projects

In all of my graduate courses I give an innovative project. In this project students are expected to apply a method learned in class to a research problem in their areas of interest. The project is structured as a conference paper and presentation. In this innovative way I help teach graduate students about the process and methods of research dissemination, helping them learn valuable skills towards their research careers.

F. Research and Publications Related to Teaching

As an Engineer it is not often that professors publish articles about teaching methods as our research is focused in very different directions. Despite this, I have participated actively in professional development related to my teaching, and my teaching philosophies and strategies have been carefully planned and thought out. I have an avid interest in teaching and I firmly believe that in the 21st century

it is our responsibility as professors to ensure the highest standards of teaching methods and pedagogy. As the letters from my students will attest, the methods and teaching strategies that I use are noticed and appreciated by my students. As my research program becomes more established, I would like to focus a bit more on the pedagogy associated with teaching Engineering students. I believe that it is important to share these experiences and successes and I intend to contribute to publications in this area. This is an area of future growth for me.

Section 3:

Appendices

This section of my Teaching Dossier contains course outlines together with sample teaching materials and course evaluations for courses which I have taught at UOIT. Sample teaching materials are meant to give the reader a general understanding of the materials and methods that I use within my teaching – they are not complete materials used within a course. PDF copies of any additional materials will gladly be provided to the Faculty Review Committee, Tenure and Promotion Committee and to teaching referees upon request.

A. *Course Outlines*

Enclosed in this section are the most recent course outlines for each of the courses which I have taught. These are group in sections for undergraduate courses, graduate courses and graduate directed studies courses.

Undergraduate Courses Outlines:

- Digital Systems - ELEE2450 / ENGR2450 — Winter 2016
- Modern Control Systems - ELEE3100 — Winter 2015
- Discrete Mathematics - ENGR2110 / CSCI2110 / MATH2080 — Winter 2008
- Probability and Random Signals - ENGR3070 — Winter 2008

Graduate Courses Outlines:

- Classical Optimization - ENGR5010 — Fall 2015
- Special Topics in Adaptive Control Systems - ENGR5930 — Spring 2014
- Analysis and Control of Nonlinear Systems - ENGR5920 — Fall 2008

Graduate Directed Studies Course Outlines:

- Directed Studies – Optimization - ENGR6004 — Fall 2014
- Directed Studies – Discrete Time Control - ENGR5004 — Winter 2010
- Directed Studies – Optimization Controls - ENGR5004 — Winter 2010

B. Undergraduate Teaching Samples

When teaching an undergraduate class my main objective is to teach students how to apply the material they have learned to more complex problems, thus also teaching them critical skills that will be important to their future careers as Electrical and Software Engineers. To ensure that students learn how to apply their knowledge I emphasize design in each of my courses.

As a sample of undergraduate teaching I have included material from two courses, ELEE2450 – Digital Systems and ELEE3100 – Modern Control Systems. I have chosen to include material from both of these courses as I feel it will provide a better picture of my overall teaching methods.

Course outlines with detailed grading breakdowns, and important dates have already been included in Section A so they are not duplicated here. Included are the following sample materials.

B.1 ELEE2450 – Digital Systems – Course Materials from Winter 2016

- Design Project Information Handout
- PowerPoint Lecture Notes from two lectures
- Midterm 1 with solutions
- Midterm 2 with solutions
- Final Exam with solutions

B.2 ELEE3100 – Modern Control Systems – Course Materials from Winter 2014

Note: Since I had surgery during the Winter 2015 semester and therefore did not complete teaching the course, I included material from the Winter 2014 instead of the most recent material.

- Handout on Textbook Selections and Resources. Note that I give students four textbooks as resources, and I point them to the appropriate sections of each book. This allows students to use a textbook which best matches their learning style as the textbooks which cover material in this course have various strengths and weaknesses.
- PowerPoint Lecture Notes from two lectures
- Information handout for students – this is a booklet entitled "Guide to hand drawn design tools" – note that this is a work in progress which is being prepared for Winter 2016. I started preparing this manuscript towards the exam for the Winter 2014 course and parts of this were used then. I have been expanding on the manuscript and this is still a work in progress.
- Pop Quiz 1 with solutions
- Pop Quiz 2 with solutions
- Midterm 1 with solutions
- Midterm 2 with solutions
- Final Exam

B.3 ELEE3100 – Modern Control Systems – Laboratory Materials from Winter 2015

In addition to course materials for Modern Control Systems, I have also included the first two labs for this course. These were redesigned by me for the Winter 2015 course

- Lab 1 – Manual for Students
- Lab 2 – Manual for Students
- Solutions for Labs 1 and 2 – for Lab TAs and Lab Coordinator

B.1 ELEE2450 – Digital Systems – Course Materials from Winter 2016

- Design Project Information Handout
- PowerPoint Lecture Notes from two lectures
- Midterm 1 with solutions
- Midterm 2 with solutions
- Final Exam with solutions

In this section, I provide samples of my teaching materials from the second year Digital Systems course. This course is taught to both the Electrical and the Software Program students. The Design Project Information Handout in this course is one of the teaching tools that I use to help students learn about practical aspects of designing digital systems. When students build their digital system and demonstrate it to their peers, the students learn not only the skills of design, but they also gain practical experience in learning how to present their ideas and designs to their peers – a skill that will help them in their future workplace. This teaching tool lines up with UOIT's strategic plan of preparing our students for the workplace.

Testing in this course provides samples of the creative way in which students are expected to learn how to apply the knowledge they have gained, instead of simply learning how to regurgitate material. In the tail end of the course I spend several weeks focusing on these types of larger scale problems, thereby teaching students how to do this by example. I have found that second year is often the first time that our engineering students are expected to apply the knowledge that they are being taught in their courses. I believe that it is fundamental that at the university level students not only learn the material, but truly learn how to apply their knowledge, thus learning an important skill that they will definitely require in the workplace, again lining up with UOIT's strategic plan.

B.2 ELEE3100 – Modern Control Systems - Course Materials from Winter 2014

- Handout on Textbook Selections and Resources
- PowerPoint Lecture Notes from two lectures
- Guide to Hand Drawn Design Tools
- Pop Quiz 1 with solutions
- Pop Quiz 2 with solutions
- Midterm 1 with solutions
- Midterm 2 with solutions
- Final Exam

In this section, I supply samples of my teaching materials from the Modern Control Systems course. This course is taught to the third year Electrical Program students. Since the course is not based out of any direct textbook, I always provide my students with a handout that ties important information in the course to sections of four different textbooks, giving students the ability to use a textbook that best meets their learning style needs.

In this third year course it is my goal to ensure that students not only learn the introductory tools of linear control systems, but also that they understand the relevance of each of these tools to design, getting an intuition of how to tweak and adjust system performance to achieve desired control of a system. I have included both the "Pop Quizes" and formal testing samples in here as they illustrate the teaching tools and styles which I employ with my third year students. In particular, the testing in the latter half of the course illustrates the application of methods taught to design problems. In the tail end of the course, problems which follow similar development to those in the testing are covered in detail so that students have practice and experience applying design tools to modern control systems. The "Pop Quizes" are used as practice homework problems for the students, and taken up in the next lecture. This allows students to try out a problem prior to the lecture so that they come into the next lecture more prepared, while having a better understanding of where their knowledge gaps are so that they are able to learn more from the lecture. The midterms also illustrate samples of how software tools such as Matlab are incorporated directly into my teaching.

Amongst the samples in this section there is also an informational handout for students that is in the development stages and will be ready for me to use in my teachings for the upcoming Winter 2017 Modern Control Systems course. This handout also goes hand in hand with a Matlab tool which I have developed for students to use in this course. The Matlab tool integrates methods of hand drawn approximation together with true simulation results, helping students to study and practice using important fundamental tools of linear control systems.

B.3 ELEE3100 – Modern Control Systems - Laboratory Manuals from Winter 2015

- Lab 1 – Manual for Students
- Lab 2 – Manual for Students
- Solutions for Labs 1 and 2 – for Lab TAs and Lab Coordinator

After reviewing the laboratory results and evaluating their relevance to the course, I redesigned part of the labs in this course during the fall of 2014. I had hoped to buy new equipment to redesign all of the labs as students did not feel connected to the lab component of the course and it did not truly reflect the material they were learning. Unfortunately, being a new University, funds are frequently limited and our department did not have the funds to purchase the equipment which I had proposed to buy for these labs. As such, I redesigned a part of the labs – using simple circuit components, which are quite cost effective, creating two labs that allow students to investigate the impact of poles and zeros on transfer functions while realizing the meaning of a system output's response to impulse, step and ramp inputs. The new labs are significantly more relevant to the course. The practical experiments in these labs enable students to connect the theory taught in this course to real life systems. In addition, they force students to study and practice an important aspect of course material outside of the lecture setting, helping them get a better intuitive understanding of a system's behaviour.

I include this material in my teaching samples for two reasons. Firstly, these labs show how I have applied a creative solution to greatly improve labs in this course in the face of extremely limited funds. I believe that this type of resourcefulness in teaching is critical in todays day and age. Secondly, in creating these labs I had the opportunity of supervising and guiding a graduate student to write the lab manual and implement my ideas for these labs. I carefully explained exactly what I wanted my undergraduate students to do in the labs, taught this graduate student the details about how to implement the systems to reflect the effects that I was interested in teaching my undergraduate students. In this secondary way, I also participated in both in training HQP as well as in teaching this student important aspects of teaching pedagogy, which he could then apply in his role as a teaching assistant for other courses at UOIT.

C. Graduate Teaching Samples

When teaching a graduate class, my main goals are:

- to introduce students to a new research area,
- teach them the necessary prerequisite skills required to be able to apply the methods taught in the course,
- teach them some of the fundamental tools and methods in this research area,
- give them the skills to be able to apply those tools to their own research in the future.

Ultimately, I strive to ensure that students will find the material both interesting and relevant. As graduate students, they should be choosing courses that will enhance their research and it is my goal to make this a reality for them. In achieve this, I structure the course to ensure that they are constantly trying out the methods taught and that they have a major project in the course which is relevant to their research goals.

As part of my teaching samples, I have chosen to give a representation of what I present to my students from the most recent optimization course taught. ENGR5010 - Optimization was taught in the fall 2015 semester. I have chosen to provide material from only one graduate course because I structure different courses in the same way, giving a representation of different materials from one course will a solid representation of how I strive to achieve my goals.

I have included the following materials to illustrate some of these teaching methods:

- Emails to students following two of my lectures.
- One set of lecture notes.
- Take home final exam.

Note that the course outline has already been provided in Section A so I have not duplicated it here. The course outline contains all the detailed information for the students about the course's project and is an important part of the sample material that illustrates my methods in teaching graduate students.

D. Teaching Evaluations from Courses Taught at UOIT

This section includes the course evaluations for each of the courses that I have taught at UOIT as well as the overall summaries. Generally, I have found that the UOIT Teaching Evaluations are not very helpful or indicative of the actual outcomes for the courses. Within my Service work I co-chaired a Teaching Evaluation Committee (TEC) in 2012-2014 that looked at these teaching evaluations and gave recommendations to the university about them. Part of the findings of the TEC were that these teaching evaluations are not effective and responses do not give an accurate indication of the quality of the teaching or the quality of the course. In particular, factors such as class size and the year of the course will often impact the evaluations but these factors are not taken into account in the evaluation process in any way. For this reason, when it is feasible to do so, for some of these courses I also did an anonymous evaluation survey at the end of the course in order to get some more detailed feedback so that I could try to improve both the course and my teaching style. These anonymous surveys are significantly more detailed than those done by the school and I have included them as well.

Graduate Teaching Evaluations:

The graduate courses that I taught have always been very well received. This is most clearly evident from the glowing student letters that I have received. There is only one teaching evaluation for my teaching of a graduate course as this was only done by the university in my first year at UOIT. The policy on evaluating graduate courses changed after that point and the courses were not evaluated beyond that point in time. In the one graduate course evaluation that I have, I had only two students in this course because of the specialized nature of the topics that were taught. This was the first year of the graduate program at UOIT and we had very few students in the first year and no students in the field of control theory were enrolled in the graduate program at that time. It was a truly rewarding experience to teach these and all of my other courses' graduate students. One of the students was even able to publish a journal paper resulting out of some of the work that he did in this course.

Attached is the course evaluation for Analysis and Control of Nonlinear Systems. UOIT stopped doing graduate course surveys after the Winter of 2008 so this is the only graduate course evaluation which I have. I have also asked for and received feedback from graduate courses as part of the final exam process, but these are clearly not anonymous thus I have not included them here.

- Analysis and Control of Nonlinear Systems (ENGR5920) Fall 2008

Undergraduate Teaching Evaluations Conducted by UOIT:

Overall, in the undergraduate courses, the UOIT standardized evaluations are neutral, whereas that the letters from students that I have received back are quite positive and often indicate outcomes that are quite the opposite from the surveys. I believe that some of the numbers on these are influenced by the fact that many of the courses which I have taught have been lower years, often to students in multiple program maps or even multiple faculties. I have taught only the second and third year students, and course evaluation numbers tend to be lowest in the lower years and often only become a better indicator of course quality when students are in fourth year and are able to start to focus on their areas of interest. Service courses, which all students in a program map must take, often get lower numbers

for these teaching evaluations. I found that I had more useful and constructive comments in the anonymous evaluation that I ran from Blackboard and WebCT. I have tried to work through the comments and the feedback on the evaluations in order to understand the main points so that they can be addressed in future courses. These main points are:

- *The course material in the courses that I cover is quite difficult for the students.*
    - It is always a difficult trade off to decide when the material is truly too difficult vs. when students are weaker in their skills than they should be. Since these courses are all specialized technical courses, due to accreditation purposes the material must be at a basic minimum threshold level. I am constantly striving to find ways to present the material that make it easier to understand for the students. Comments in letters that I have received from students would indicate that I am succeeding in portraying material to students in a way in which they can both recognize that material is not easy, yet be able to process and understand it.

- *Students feel that my testing is too difficult – they feel that testing should be identical to format to questions that they have seen before and that applying their knowledge is beyond a reasonable expectation.*
    - I do feel strongly that at a university level testing should not be a simple regurgitation of material, but rather a testing of the students' ability to apply their knowledge and combine ideas which they have learned in order to tackle solutions to more complex problems. In particular in the second year courses students are not used to this. In order to help the students prepare for tests I always ensure that they have prior years tests available to them. (When I teach a course for the first time I always make a mock test that I provide to them prior to their taking a real test so that they know what the expectations are.) I also make sure that the students know that I am available and happy to give them any extra time they need. For my fourth year course, when the TA was not skilled in the subject matter I also gave multiple extra tutorials to help the students prepare. I also do and will constantly try to make sure testing is not too hard.

Despite varying comments, I think the main issue that the students often have had with my courses really was that they felt that both the material and the testing of the material was too difficult. I believe that as an accredited program, we must provide a reasonable standard in our expectations from the students both in the material they cover and in how we check to ensure that they understand that material. Overall, students felt that my testing was too difficult and they generally did not like it when questions tested their ability to reason out more complex problems. After discussions with more senior faculty, it is my understanding that we do not want to lower our standards as a university as this could impact negatively on our accreditation. Instead of giving "easy" tests, I always try to give students every chance to improve their grade, for example, I give them two midterms and allow them replace their first midterm grade with the second if they show improvement. Despite this, the students clearly do feel that my testing is too hard for some of them. This can be frustrating as a teacher when many of the high school students who enter our engineering faculty have exceptionally lower high school averages than those encountered at other universities' engineering programs – and most of these are passed through

first year and only encounter their first "difficult" course when they reach second year. This has been slowly improving over my years at UOIT, but is still evident when those entrance averages are compared to other engineering programs across Canada. A large number of my classes have been at the second year level. In the past, there have also been some faculty acknowledged issues with some of the cohorts in the ECSE program. The issue of midterm difficulty is one that I am constantly striving to address and I hope to have some input on what the expectations are from the administrative perspective on this issue.

Attached are course evaluation summaries and course evaluations for all courses which I have taught since joining UOIT. These are listed and included in the following order:

Multiple Course Teaching Summaries

- Multiple Course Teaching Summary — Fall 2008-Winter 2016
- Multiple Course Teaching Summary — Fall 2007-Winter 2008

Digital Systems – class sizes ranged from approx. 50-75 in the earlier years in which I taught the course and 120-140 in the later years in which I taught the course. These classes include a mix of both the electrical and software engineering cohorts.

This course was originally a very large single class, but as the class-size has grown beyond UOIT's ability to accommodate it as a single class, the course is now separated into two separate sections.

- Digital Systems (ELEE2450) – Section 001 — Winter 2016
- Digital Systems (ELEE2450) – Section 010 — Winter 2016
- Digital Systems (ELEE2450) — Winter 2014
- Digital Systems (ENGR2450) — Winter 2010
- Digital Systems (ENGR2450) — Winter 2009
- Digital Systems (ENGR2450) — Winter 2008

Modern Control Systems – class sizes ranged from approx. 20-60 in the earlier years in which I taught the course and 55-75 in the later years in which I taught the course.

This is one of the courses with the most noticeable growth in class size. It is a difficult course for students in their third year and it was much easier to focus on the students with the smaller class sizes. This will be a challenge to tackle in this coming year when the class size is expected to be around 80.

- Modern Control Systems (ELEE3100) — Winter 2014
- Modern Control Systems (ENGR3100) — Winter 2010
- Modern Control Systems (ENGR4100) — Winter 2010
- Modern Control Systems (ENGR4100) — Winter 2009

Discrete Mathematics – classes included students from three different faculties and there were approximately 100 students in the combined class each of the years when I taught it.

Teaching this course to three different groups was not a good combination as their respective backgrounds were very different which meant that there was not a common interest area to

draw on to bring the material together. This was brought up at curriculum evaluation meetings and was later changed because of the bad impacts on the students of doing this.

- Discrete Mathematics (ENGR2110) Fall 2008
- Discrete Mathematics (CSC2110) Fall 2008
- Discrete Mathematics (MATH2080) Fall 2008
- Discrete Mathematics (ENGR2110) Fall 2007
- Discrete Mathematics (CSC2110) Fall 2007
- Discrete Mathematics (MATH2080) Fall 2007

Probability and Random Signals – this course was taught only once with a class size of 32.

This was the first time the course was offered. There were some significant problems with the students' preparation for the course – I was totally unaware that they had not been taught double integration in the prerequisite calculus III course. This was supposed to be covered in that course.

- Probability and Random Signals (ENGR3070) Fall 2007

Undergraduate Teaching Evaluations Conducted by Me Through WebCT:

I have conducted my own anonymous teaching evaluations both with the newer Blackboard system and with the previous WebCT system. In this section I have only included the WebCT surveys because the blackboard surveys come out in a very difficult to follow spreadsheet format which it is not possible to relay by simply printing it. The outcomes of my Blackboard surveys are quite similar to the WebCT surveys, so what is provided here is illustrative of student comments in these. Below are some interesting quotes taken from the student evaluations:

"Although my grade in the course will not be the best, it was actually the most interesting course this semester. I actually looked forward to studying for it."

"This course was fantastic, we learned a lot of control theory. In general, in talking with other students this is the one course that they really liked and enjoyed and I agree with them. Also, the professor was very enthusiastic and really made the course more enjoyable. The attention and level of commitment to the students shown by the professor to the students was transparent and truly appreciated."

"Dr. Milman is very knowledgeable, engaging, dynamic and empathetic. She will accommodate students in terms of taking extra time to come to tutorials so that students understand course material. She cares a lot for the students and that is greatly appreciated. Also, she's very and approachable and willing to help students outside class time."

"Dr. Milman is a great professor. She presents the course material with knowledge and enthusiasm. Her lecture slides are the best resource we have in the course, which is why it is frustrating that her computer always crashes during lecture. Dr. Milman's computer often freezes during lecture causing us to lose time when it restarts. Sometimes we are able to use the black/white boards to complete our notes, but that becomes impossible when we are in U5

for our class." *(Note – this was a UOIT computer which I replaced I replaced with an iPad to solve this problem during the next semester.)*

"I find the course material to be abstract and difficult to understand, but I feel that Prof. Milman does her best to convey the material in an effective manner."

"Prof. Milman's exams tend to be extremely difficult because they involve questions that test applications of our knowledge that many of us are not used to. I would suggest that Prof. Milman include harder examples in her lecture notes to help students become more familiar with the idea of thinking outside of the box and applying their knowledge beyond simple applications. "

A particularly interesting point to note is that the comments that my students make in these surveys line up with the comments that I have received in my solicited undergraduate student letters. These are very positive and illustrate that I am succeeding in my teaching goals, and that my efforts to explain difficult material while not simply "dropping the bar" are realized and recognized by my students.

Attached are sample anonymous WebCT based course surveys that I have asked my students to complete as part of the courses which I have taught multiple times. These are listed and included in the following order:

- Modern Control Systems (ENGR4100)
- Digital Systems (ENGR2450)
- Discrete Mathematics (ENGR2110)

E. Student Achievement

The students whom I have supervised have continued on to have great successes in life. They have generally proceeded from UOIT to high profile electrical engineering jobs in industry. Of the 42 undergraduate students whom I have directly supervised, five of them have proceeded to graduate school – one of them under my supervision. Similarly, the graduate students whom I have supervised have primarily proceeded to senior controls engineering positions.

I have attached an alphabetical list below of all of the students whom I have directly supervised and their places of employment where known.

Graduate Students

Timothy Teatro	*(degree in progress)*	
Mariam Fatima	*(graduated 2012)*	*System Engineer at Averson Inc.*
Muhammad Awais Abbas	*(graduated 2012)*	*Controls Engineer at General Motors*
Jonathan Hodgkins	*(graduated 2012)*	*unknown*
Harris Chowdhry	*(graduated 2010)*	*Senior EMC Engineer at Advanced Micro Devices*
Gabriel Alcantara	*(left graduate program)*	*unknown*

Undergraduate Students

Shoaib Akhtar	(2015-16)	Employed as an In house Electrical Engineer
Yazeed Al-jedaibi	(2015-16)	Employed as an Engineer in Saudia Arabia
Andrei Bandoc	(2014-15)	Modernization Coordinator at Schindler Elevator Corp. – Planning to do a masters part time at UOIT soon.
Bryce Benn	(2014-15)	Consultant at FDM Group Ltd.
D'Andrade Browne	(2014-15)	*unknown*
Peter Budd	(2008)	QA Manager at E.S. Fox Ltd.
Mohshina Chowdhury	(2009-10)	Project Engineer at General Motors
Robert-Nikola Dejanovic	(2014-15)	Employed at Max Power Electrical Consultants
Fahim Faqirzai	(2009-10)	Utility Co-ordinator at 407 East Construction General Partnership
Mariam Fatima	(2008)	Completed M.A.Sc. at UOIT under my supervision
Jonas Fernandes	(2014)	Research Assistant in the Automotive Centre of Excellence, Brazil
James Forde	(2008-09)	*unknown*
Anton Gavrilov	(2008-09)	Flushby Specialist at Al's Trucking Services
Davin Gibson	(2008)	*unknown*
Robert Greer	(2010)	Proceeded to graduate school at UOIT, Currently a Senior Data Analyst at the Hospital for Sick Children
Ira Gupta	(2009-10)	Electrical Engineer at Suncor Energy

Sabah Hanna	(2015-16)	Accepted into graduate program at UOIT, but has deferred for a year to work as an engineer for General Motors in Detroit
Samantha Hazell	(2009)	Specialist, Business Planning at Toyota Moro Manufacturing Canada
Larry Hocken	(2014-15)	Working in the Canadian Armed Forces
Joseph Horobetz	(2009-10)	*unknown*
Farooq Hyder	(2015-16)	Electrical Engineer Intern at Oshawa PUC Networks Inc.
Kenosi Katjipaha	(2009-10)	Assistant Engineer at Botswana Power Corporation
Rashid Mahmood	(2015-16)	*unknown*
Sarim Mahmood	(2014-15)	Junior Quality Assurance Analyst at Flipp
Mustafa Malik	(2014-15)	*unknown*
Chris Mansell	(2009-10)	QA Specialist at Hyundai Auto Canada
Kemunto Mochama	(2008-09)	proceeded to graduate school at Waterloo University
Mansi Modi	(2008-09)	Assistant Distribution Lines Officer, Engineer at Hydro One
Neujan Muthiah	(2009-10)	*unknown*
Jeffrey Omovie	(2014-15)	Graduate Student at UOIT
Chasiwa Omphemetse	(2009-10)	Plant Engineer at Morupule Power Station
Raymond Papa	(2014-15)	Tolling Technician at 407ETR
Jaykumar Patel	(2014)	Currently completing a professional experience year at Bruce Power and will be returning to 4th year in Sept.
Samina Rahmanyar	(2016)	current UOIT student, entering 3rd year
Blessing Sebinyane	(2009-10)	Control & Instrumentation Section Engineer
Ahmad Shamshiri	(2014-15)	Employed by UOIT as technical staff for FEAS
Muhammad Sheikh	(2015-16)	Employed as an RF Engineer in a company in Ottawa
Omar Shoukat	(2015-16)	Summer research job at UOIT
Calvin Soenjaya	(2008)	Construction Project Manager – Power Generation Region
Ian Spencer	(2008)	*unknown*
Muhammad Umar	(2015-16)	Proceeding to graduate school at UOIT
Shirva Wells	(2008-09)	*unknown*

Section 4:

Solicited Reviews

Included in this section are solicited reviews and letters of support from colleagues, graduate students and undergraduate students. These are subdivided as follows:

A. Letters from Colleagues

- Prof. Jing Ren

B. Graduate Student Letters

- Timothy Teatro
- Haris Chowdhry
- Mariam Fatima
- Zhongxing Yang
- Daniel Bondarenko
- Mahmoud Eid
- Hossein Gohari
- Benkai Liang
- Dimpal Dadhania
- Hassan Rabbani

C. Undergraduate Student Letters

- Muhammad Umar
- Samantha Hazell
- Ahmad Shamshiri
- Sathepan Najendrajah
- Stewart Hannah
- Omar Shakhout
- Rashid Mahmood
- Samina Rahmanyar

D. Letters Solicited from Third Year Review

- Samantha Hazell
- Kemunto Mochama
- Mariam Fatima
- Thomas McConkey
- Anton Gavrilov
- Joseph Horobetz
- Shirva Wells
- Deanna Williams
- Kevin Pope
- Mauricio Hernandez

A. Letters from Colleagues

- Prof. Jing Ren

The following review comes from Prof. Jing Ren who works in a research area related to mine and who is familiar with the courses I teach as well as with my teaching materials and student interactions. Prof. Ren has taught the ELEE3100 Modern Control Systems course with my teaching materials. Although this review is included in the solicited reviews, I did not actually solicit letters from colleagues, since these will be solicited by the Dean, in a later part of the tenure review process. This letter was offered to me unsolicited, by Prof. Ren on her own, due to her familiarity with my courses and research work.

B. Graduate Student Letters

- Timothy Teatro
- Haris Chowdhry
- Mariam Fatima
- Zhongxing Yang
- Daniel Bondarenko
- Mahmoud Eid
- Hossein Gohari
- Benkai Liang
- Dimpal Dadhania
- Hassan Rabbani

As part of my preparation for the tenure review process I have solicited letters from graduate students who are familiar with my supervision and/or teaching. The first three of these letters come from my own graduate students and the remaining letters come from students who have taken my graduate courses. These letters speak for themselves, attesting to my success in achieving my teaching goals. Some quotes from these letters that speak directly to my teaching successes include:

"Her state of the art teaching helped me see the beauty of doing research."

"I found Prof. Milman to possess outstanding academic and personal qualifications. She always came to class well prepared. Her conceptualization, organization and communication skills are excellent."

"Professor Dr. Milman is incredibly accessible and does an amazing job at making difficult concepts easily understandable."

"Her expert wielding of fundamental knowledge guaranteed something interesting would come from each lecture that would give us deep insights into new topics, while redeveloping our grasp of the fundamentals"

"She is open to her students and glad to swap ideas and opinions, which not only akes her more sensitive to student's confusion but also makes the communication more effective."

"She is a knowledgeable person in the areas of her subjects and knows well how to make herself well-understood."

"Her gentle but firm approach teaches students strategies which give them the confidence and support to become independent learners in the mainstream classroom."

"She is always willing to help struggling students with a smile on her face."

"Her course in Advanced Optimization was one of my best experiences of graduate studies in UOIT."

"I can say doctor Ruth is a perfect professor"

C. Undergraduate Student Letters

- Muhammad Umar
- Samantha Hazell
- Ahmad Shamshiri
- Sathepan Najendrajah
- Stewart Hannah
- Omar Shakhout
- Rashid Mahmood
- Samina Rahmanyar

The following letters from undergraduate students relate both to classroom teaching and to supervision. Like the graduate student letters, I believe these speak for themselves. They are a true testament of my successes in teaching, illustrating that I am succeeding in achieving my teaching goals and objectives. These letters furthermore illustrate the many ways in which my teaching is an asset to UOIT's undergraduate program. Some notable quotes from these letters include:

> "Dr. Milman is one of the most extraordinary professors I had during my undergraduate degree at the University of Ontario Institute of Technology."
>
> "Overall, Dr. Milman is an outstanding professor, supervisor and mentor, but what stands out most about her is her genuine interest in the success and lives of her students."
>
> "Dr. Milman is incredibly accessible and does an amazing job at making difficult concepts easily understandable."
>
> "She often took a practical approach to learning to ensure that not only did we understand the importance of theories, but that we could see how to apply these theories to the real world to simplify and solve complex problems."
>
> "Dr. Milman was one of my toughest professors. She set high expectations to challenge her students to accomplish more. Despite the often difficult material in her courses, Dr. Milman always found ways to relate the material to her students in a way that made it easier to understand."
>
> "She wanted us (the students) to, quote, "not regurgitate the lecture", but to learn how to creatively apply the education in testing, assignments, and by extension, future work. And, given the nature of the fields she teaches, this becomes a very important skill for students to pick up."
>
> "Dr. Milman is extremely organized in terms of the course material and delivery. She thoroughly explains the concepts and encourages her students to ask questions if they do not understand. Dr. Milman not only teaches the concept, but additionally teaches the class about design and the steps required to have a successful design."

"She has a naturally enthusiastic and friendly personality which allows students to feel comfortable with asking questions and expressing their difficulties. Not only is she patient, but she also very articulate and a clear communicator."

"Dr. Milman was an amazing professor who I found approachable and eager to help her students."

"For the first time in my academic career, I felt a professor was able to strongly express that she prioritized spending time on the development of students' skills."

"In my 4th year of my undergraduate studies I took Modern Control Systems Design with her and I can say this without any doubt that her passion and motivation drove me to further pursue my studies in the same field."

" I developed a passion for control systems because of Dr. Milman's dedicated teaching style."

"Dr. Milman is available to help her students at any of her free time and is greatly concerned with her students' success."

"She would go beyond the role of educator and encourage students along their professional and personal development as well."

"An important aspect of Professor Milman's interactions with her students is her availability to answer questions, her interest in her students' work, the ability to provide just the right amount of structure and yet allow the students some independence as well.

"I believe that the high level of her current and future work and outstanding rapport with the students will greatly bolster UOIT in the Control System and Electrical Engineering areas."

D. Letters Solicited from Third Year Review

- Samantha Hazell
- Kemunto Mochama
- Mariam Fatima
- Thomas McConkey
- Anton Gavrilov
- Joseph Horobetz
- Shirva Wells
- Deanna Williams
- Kevin Pope
- Mauricio Hernandez

I have included letters solicited from Third Year Review as part of this Section in order to show that there is consistency over the years in my students' positive comments. The first eight of these letters are from undergraduate students and the last to are from graduate students. Like the letters solicited for my tenure review, these letters, which were solicited for my third year review, clearly reflect my teaching pedagogy and indicate that I have been succeeding in my teaching goals and objectives. Some notable quotes from these letters which were written in 2009 include:

> "Currently, I am pursuing graduate studies at University of Waterloo, studying nonlinear control systems. It is because of the courses, research, and discussions I have had with Dr. Milman that I have chosen this career path"
>
> "Dr. Milman is a strong professor capable of always challenging her students to set the bar higher."
>
> "As a student I have come to expect nothing less than a challenge in Dr. Milman's courses as she encourages us to take an active interest in our education by applying our theoretical engineering knowledge to real life engineering applications."
>
> "As a professor, what struck me most about Dr. Milman, is that she displayed a high degree of professionalism, leadership and integrity." … "As an advisor she is knowledgeable, insightful, and helpful." … "As a mentor, she is personable, generous and thoughtful."
>
> "Dr. Milman is an outstanding professor, a great advisor, a strong mentor and a valuable resource."
>
> "Dr. Milman is a competent teacher with strong work ethics. She possesses an open, accessible personality."
>
> "Dr. Milman encourages her students to work hard and achieve high levels of success."

"Her teaching style has changed and improved during her time at UOIT." … "This ability to improve and adapt to student input is a key asset for teaching in any field."

"Prof. Milman made the material both stimulating and challenging."

"The most distinctive quality about Dr. Milman was her willingness to assist students. She always made herself available to students that required guidance and gave extremely valuable suggestions."

"Dr. Ruth Milman was a mentor to me in my second year of study in the way that she treated us with so much respect, honesty and maturity. I never felt like an adult in school until Dr. Milman's class. I'll admit, at first I was very intimidated, but as the semester carried on, all of her predictions came true, and here I was thinking, wow she was really looking out for my best interest! This as about half way through the semester and I found myself taking the course and myself a lot more seriously. The course I felt I was destined to fail and never understand was now the course that gave me academic confidence and an A on my transcript. To be fair, I owe her a thank you."

"The greatest impact on my educational progress came from obtaining my thesis project from her in my final years of study. Her idea of an autonomous vehicle concept inspired me to pursue my future in hardware design and microcontroller programming."

Closing Statement from Candidate

August 15th, 2016

Dear Colleagues,

The package you have just read illustrates my commitment to UOIT and to my profession through the areas of Research, Teaching and Service. Much thought, effort and time has gone into compiling these documents, which illustrate how I have met and exceeded the criteria for tenure.

While putting this tenure review package together, I have had the opportunity to be introspective about what research, teaching and service mean to me and about my time at UOIT. I can truly say that I love what I do as a professor at UOIT. I enjoy all aspects of research, teaching and service. This is always most evident to me when I am supervising or mentoring students. They are our future and more than anything else, our students stand for what UOIT is, promoting the university to waves of future students simply by sharing their good experiences. I am proud to be a part of this university community, being able to help guide students who are on their own path the careers and future successes.

In my job search that took me here, UOIT was my first choice of a workplace specifically because it was important to me to be able to make an impact and to feel that I could truly contribute to my university community. In my path at UOIT I feel that I have gotten to know a lot of special people along the way – both colleagues, students and administration. I am glad to say that I truly do feel that I have had the opportunity to make a difference and I intend to continue to always strive to make that difference.

Again,
Thank you for your consideration,

Ruth Milman
Assistant Professor
University of Ontario Institute of Technology
Faculty of Applied Science and Engineering
Department of Electrical, Computer and Software Engineering