UOIT
CHALLENGE INNOVATE CONNECT

Master of Engineering in Engineering Management (MEngM)

and

Graduate Diploma in Engineering Management

September 2010

VOLUME I: The Program

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VOLUME I: The Program

1. INTRODUCTION

1.1 Brief listing of program

The Faculty of Engineering and Applied Science (FEAS) and the Faculty of Energy Systems and Nuclear Science (FESNS) at the University of Ontario Institute of Technology (UOIT) propose to jointly offer courses in a new master's program leading to a Master of Engineering Management (MEngM) degree. Similar to other Master of Engineering (MEng) programs offered by the university, the MEngM program will consist of either 10 courses (MEngM-Course) or 7 courses and a major research project (MEngM-Project). Students will be permitted to select courses offered by FEAS and FESNS but will have FEAS as their home Faculty. The program is expected to start in September 2011, or as soon as possible after necessary approvals are received.

To earn a Graduate Diploma in Engineering Management, students will complete four engineering management courses, two core and two elective courses.

In addition to the above proposed program, FEAS offers MASc and MEng degrees in Mechanical, Automotive, Electrical and Computer Engineering, and PhD degrees in Mechanical Engineering and Electrical and Computer Engineering. FESNS currently offers MASc, MEng and PhD programs in Nuclear Engineering.

1.2 Background

UOIT is Ontario's newest university. UOIT accepted its first undergraduate engineering students in the fall of 2003. Undergraduate engineering degrees at UOIT are offered in both FEAS and FESNS. FEAS first offered an undergraduate program in Manufacturing Engineering in the fall of 2003. In the fall of 2004, FEAS added an undergraduate program in Mechanical Engineering with the following options: Comprehensive, Energy or Mechatronics options. In the fall of 2005, undergraduate programs in Automotive, Electrical, and Software Engineering were started. With the rapid growth and success of the undergraduate engineering programs at UOIT, FEAS launched MASc and MEng programs in Mechanical Engineering (fall 2006), Electrical and Computer Engineering (fall 2007), Automotive Engineering (winter 2008) and PhD programs in Mechanical Engineering (fall 2008) and Electrical and Computer Engineering (fall 2009).

The Faculty of Energy Systems and Nuclear Science first offered an undergraduate program, a BEng (Hons) in Nuclear Engineering, in the fall of 2003. Concurrently, the undergraduate program BSc (Hons) in Radiation Science commenced. In the fall of 2004, FESNS added an undergraduate program BEng (Hons) in Energy Systems Engineering. It launched MASc and MEng programs in Nuclear Engineering, with fields in Nuclear Power and in Radiological and Health Physics in May of 2008, followed by a PhD program in Nuclear Engineering that started in May 2010.

The launch of an MEngM program in Engineering Management is the next important step for UOIT in offering a range of engineering post-secondary education in areas where significant needs exist and faculty capabilities are present. UOIT also launched in 2009 an MBA program. The proposed MEngM program will serve as a complement to the MBA program for those engineers who do not wish to pursue a business oriented MBA, but yet would like to receive graduate education in engineering management areas. The program will be operated similarly to the MBA program under full cost recovery on a tuition fees per credit system. Section 4.2.3 specifies the degree requirements for the proposed MEngM in Engineering Management. These include 3 Engineering Management courses (9 cr.) from a core group, 3 Engineering Management elective courses (9 cr.) and an additional 12 credits from one of four existing graduate engineering programs. These include:

- Mechanical Engineering;
- Electrical and Computer Engineering;
- Automotive Engineering;
- Nuclear Engineering.

Each of the engineering graduate degree programs noted above has been previously reviewed and approved by the Ontario Council on Graduate Studies (OCGS).

The table below summarizes the degrees, fields within those degree programs (where appropriate) and graduate diplomas offered for each of the four engineering disciplines. The programs' dates of approval from OCGS are also identified.

Degree(s)	Field(s)	Date of OCGS Approval
MECHANICAL ENGINEERING		
MASc/MEng	Energy / Thermofluids Engineering Mechatronics / Manufacturing	December 19, 2005
PhD	Energy / Thermofluids Engineering Mechatronics / Manufacturing Automotive Engineering	June 20, 2008
ELECTRICAL AND COMPUTER ENGINEERING		
MASc/MEng	No declared fields	June 20, 2008
PhD	Communications / Signal Processing Software Systems Control Systems	March 27, 2009
AUTOMOTIVE ENGINEERING		
MASc/MEng	No declared fields	March 16, 2007

NUCLEAR ENGINEERING		
MASc/MEng	Nuclear Power Radiological and Health Physics	March 14, 2008
PhD	Nuclear Power, Energy Applications Radiological and Health Physics	January 22, 2010
Graduate Diplomas	Fuel Materials and Chemistry Operations and Maintenance Reactor Systems Health Physics Safety, Licensing, Regulatory Affairs Radiological Applications	November 21, 2008

The main focus of this brief is to highlight the areas which have special relevance to the proposed area of Engineering Management. These include: introduction and background, program learning outcomes, program structure, admission and degree requirements, faculty and library resources and new courses which have been created, or existing courses which are deemed to be particularly relevant to the discipline of Engineering Management.

1.2.1 Other programs

As of January 2010, there were 14 universities offering graduate programs in engineering in Ontario. Table 1-1 lists engineering programs that have a management component. Many of the programs in the Greater Toronto Area have a specific focus, such as management of technology or the environment. Details of the various programs are given in Appendix C. The American Society of Engineering Management (http://www.asem.org/about/index.html) writes:

"Engineering Management is the art and science of planning, organizing, allocating resources, and directing and controlling activities which have a technological component. Engineering Management is rapidly becoming recognized as a professional discipline. Engineering managers are distinguished from other managers by the fact that they possess both an ability to apply engineering principles and a skill in organizing and directing technical projects and people in technical jobs."

The proposed MEngM program at UOIT is distinct from an MBA because it is designed to provide courses with instruction in engineering project management, production planning and operations management, mathematical modeling and optimization as they pertain to complex engineering systems, quality control, health and safety, and applied risk analysis. The program will provide students with a broad understanding of the applications in the field of Engineering Management. This is different from other programs which focus, for example, only on technology innovation or environmental management As such, the proposed graduate level program in MEngM is unique in the Greater Toronto Area.

Table 1-1 – Graduate Engineering & Management Programs in Ontario as of 2010		
University	**Programs**	**Degrees**
University of Ottawa	Engineering Management	MEng
Carleton University	Technology Innovation Management	MASc/MEng
McMaster University	Engineering Entrepreneurship & Innovation Engineering & Public Policy	MEEI MEPP
Royal Military College of Canada	Defence Engineering & Management	MDEM
Ryerson University	Environmental Applied Science & Management Management of Technology & Innovation	MASc MBA/MMSc
University of Toronto	Engineering & Management	BASc & MBA (2 degrees)
University of Waterloo	Masters of Applied Science Masters of Management Sciences Masters of Management Science online via Management of Technology Option	MASc//PhD MMSc MMSci

Sources: Review of programs offered by all Ontario Universities.

On the page that follows, Figure 1-1 shows the cities that offer engineering graduate programs in Southern Ontario. Kingston, Toronto, and Ottawa have two universities offering graduate programs.

Figure 1-1: Cities Offering Graduate Engineering Programs in Southern Ontario (Large Circles) and the Location of the University of Ontario Institute of Technology in Oshawa
Source: Yahoo! Maps (http://maps.yahoo.com/)

1.2.2 Graduate program demand

The global economy has changed drastically over the past few years, which has led to major shifts in job opportunities and educational requirements of engineers. Also, a large proportion of new immigrants to Canada have settled in the Greater Toronto Area (GTA) and they wish to upgrade their skills with graduate degrees for employment opportunities. These two trends are expected to contribute to strong demand for graduate education in Engineering Management at UOIT. Since the launch of graduate programs by UOIT in 2006, the number of graduate students at the end of 2009 has grown to over 300, with over half of those enrolled in engineering programs.

According to the American Society for Engineering Management (ASEM), Engineering Management is recognized as a professional discipline, separate from an MBA or other business management programs. ASEM states that approximately two-thirds of all engineers spend a substantial portion of their professional careers as managers (http://www.asem.org/about/index.html). Hence, graduate level training of engineers in the management sciences is an important element in maintaining competitiveness in industry.

The Canadian Society for Engineering Management (CSEM) offers similar statistics. Almost half of all engineers enter a management position within 10 years of graduation. Fully half of all registered professional engineers primarily utilize management skills rather than technical skills (http://www.csem-scgi.ca/).

The ability to manage and administer large technical engineering and research projects and budgets constitutes a significant challenge. Specialized education and resources are needed to develop and enhance students' essential management skills. The proposed program in Engineering Management is a

direct response to these identified needs. The program will provide students (who have undergraduate degrees in engineering) the opportunity to combine advanced engineering knowledge with managerial skills. This program will enhance the capabilities of its graduates, giving them a competitive advantage in the global marketplace and preparing them for management roles in both private and public sectors.

The program proposed by UOIT and the location of the university make it an advantageous choice for developing engineering graduate program capacity in Ontario. Figure 1-2 shows the location of graduate engineering programs in the GTA and neighbouring cities. Other than UOIT, all of the graduate programs in the region are located in the centre of the GTA or in neighbouring cities west of the GTA. The location of UOIT makes it an excellent choice for increasing engineering graduate program capacity to the eastern side of the GTA and neighbouring cities. In addition to having a strategic location based on the rapidly growing population in the east GTA, the location of UOIT is also ideal due to its proximity to many companies in the eastern GTA. These companies include General Motors Canada, Ontario Power Generation, Siemens, Messier-Dowty, and many others. These companies and others have a large proportion of engineers and hence provide a demand for the proposed Engineering Management program.

Figure 1-2: Universities Offering Graduate Engineering Programs within the Greater Toronto Area (GTA) and Neighbouring Cities, and the Location of the University of Ontario Institute of Technology
Source: Yahoo! Maps (http://maps.yahoo.com/)

1.3 Objectives of the program

There are four objectives below that are common to all of the engineering graduate programs.

Depth: To provide students with an understanding of the fundamental knowledge prerequisites for the practice of, or for advanced study in, engineering, including their scientific principles, analysis techniques, and design methodologies.

Breadth: To provide students with the broad and advanced education necessary for productive careers in the public or private sectors and academia, for the successful pursuit of their careers.

Professionalism: To develop skills necessary for clear communication and responsible teamwork, and to inspire professional attitudes and ethics so that students are prepared for modern work environments and for lifelong learning.

Learning Environment: To provide an environment that will enable students to pursue their goals through innovative graduate programs that are rigorous, challenging, and supportive.

A key objective of the MEngM program is to provide an educational opportunity for engineers in industry to upgrade and expand their skills, both technical and managerial. Graduates of the program will apply their education of various engineering management techniques in applicable industry sectors. The objectives of the program will be achieved through the completion of either 10 graduate level engineering courses (MEngM-Course) or 7 courses and a major research project (MEngM-Project). Students will gain management knowledge through a set of core engineering management courses. Students will also expand their engineering technical skills by taking engineering electives from existing graduate programs offered by FEAS and FESNS.

The Engineering Management Program is designed to apply practices in the management sciences to engineering practise. Students will develop the necessary knowledge and skills to successfully manage complex engineering projects, prepare and implement business plans for engineering tasks and to coordinate all functions of a modern industrial enterprise. In addition to learning about the tools and techniques of engineering management, students will also gain a broader understanding of the issues facing all organizations and individuals in a fast paced engineering workplace.

1.4 Method used for preparation of the brief

This appraisal was prepared by a sub-committee of the FEAS Graduate Committee, in consultation with FESNS and the Faculty of Business and IT. The lead program co-developers were Dr. V. Quan and Dr. G. F. Naterer. Many faculty members have contributed significantly in various ways to the development of this proposal. The appraisal has received thorough review by the FEAS Graduate Studies Committee and FEAS Faculty Council, FESNS Graduate Studies Committee, FESNS Faculty Council, UOIT Graduate Studies Committee, Academic Council Executive and the Academic Council of UOIT.

1.5 Fields in the program

There are no declared fields in this Engineering Management program.

1.6 Review of concerns expressed in previous appraisal

As this is an application for a new program, this section is not applicable.

1.7 Special matters and innovative features

As noted in section 1.2.2, Engineering Management is recognized as a professional discipline, separate from an MBA or other business management programs. The American Society for Engineering Management (ASEM) states that approximately two-thirds of all engineers spend a substantial portion of their professional careers as managers (http://www.asem.org/about/index.html). The proposed program has been designed to respond to a distinct need.

The proposed MEngM program at UOIT is both unique in the Greater Toronto Area and distinct from an MBA. The outcomes and curriculum have been carefully designed to provide students with theory and skills that complement their technical expertise and enable them to become effective professional managers. Students will receive instruction in such areas as: engineering project management; production planning and operations management; mathematical modeling and optimization as they pertain to complex engineering systems; quality control; health and safety; and applied risk analysis. The program will provide students with a broad understanding of the applications in the field of Engineering Management, rather than specifically focusing only on a single area, such as technology innovation or environmental management. This will better prepare them for the specific managerial requirements of their discipline.

In addition to taking courses, students enrolled in the MEngM program will be required to attend a series of seminars by speakers with experience in the disciplines of engineering management. These include production and operations managers, project managers, entrepreneurs, quality and safety managers and various other engineering practitioners in the field. This will complement the students' studies with direct insight into the issues and challenges they will encounter in engineering management.

The University of Ontario Institute of Technology provides each of its students access to its Mobile Learning Environment. Every graduate student at UOIT will have wireless and wired access to library resources, email, and the internet, in addition to other online services.

Students enrolled in the MEngM program will have access to three state-of-the-art facilities that are unique to Canada: the Automotive Centre of Excellence (ACE), the Borehole Thermal Energy Storage System (BTESS), and the Energy Research Centre (ERC). The ACE, BTESS and ERC will provide an opportunity for graduate students in the program to conduct course projects in a variety of engineering fields. Details about the ACE, BTESS and ERC as well as other laboratory facilities are provided in Section 3.2.

2. THE FACULTY

2.1 List of faculty

Table 2-1 lists the faculty members involved in the Engineering Management graduate program and identifies their gender and home unit. Expected retirements within the next seven years are also noted.

Most of the professors in Table 2-1 are classified as Category 3 because they are participating in other UOIT graduate programs, in addition to the proposed program. The majority were hired for a specific engineering program (i.e. Automotive, Mechanical, Electrical and Computer, Nuclear). Most have industry experience and have spent a portion of their professional career as managers. This background enables them to contribute effectively to teaching and/or project supervision in the proposed program. There are also four professors from the Faculty of Business and Information Technology (FBIT) who were originally hired to participate in UOIT's MBA program.

In UOIT's interdisciplinary environment, it is not uncommon for faculty members to be involved in more than one graduate program. Professors' involvement in a program may range from membership on a student's supervisory committee to teaching and direct supervision of one or more students in the program. The assignment of faculty members to a particular category is based on whether or not they have been included as contributing faculty members in earlier OCGS program submissions, not on the intensity of their involvement in the program under review. Classification as a Category 3 faculty member does not mean that the professor would have more restricted involvement in the program than his/her Category 1 colleagues.

MEngM students will take their technical elective courses from UOIT's graduate engineering programs where these professors are designated Category 1.

Graduate faculty appointments, categories of graduate teaching, and supervisory privileges are described in Section 2 of the General Policies and Procedures for Graduate Studies at UOIT. For details, see http://gradstudies.uoit.ca/EN/main/grad_admininistration/policies_and_procedures.html.

Currricula Vitae for all faculty members listed in Table 2-1 are provided in Volume II of this submission.

Table 2-1: Faculty Members				
Name	**Rank**	**M/F**	**Retirement Date**	**Home Faculty**
Category 3				
Barari, A.	Assistant	M		FEAS
Bereznai, G.	Professor	M	2012	FESNS
Dincer, I.	Professor	M		FEAS
Gabbar, H.	Associate	M		FESNS/FEAS
Goodman, B.	Associate	M		FBIT
Grami, A.	Associate	M		FEAS
Ham, M.	Assistant	F		FEAS
Harvel, G.	Associate	M		FESNS
Karray, S.	Associate	F		FBIT
Kishawy, H.	Professor	M		FEAS
Lu, L.	Assistant	F		FESNS/FEAS
Machrafi, R.	Assistant	M		FESNS
Percival, J.	Assistant	F		FBIT
Pioro, I.	Associate	M		FESNS
Reddy, B.	Associate	M		FEAS
Rosen, M.	Professor	M		FEAS
Surti, C.	Assistant	M		FBIT
Zhang, D.	Associate	M		FEAS
Category 4				
Bennett, M.	Lecturer	M		FEAS
Quan, V.	Lecturer	M		FEAS

Category 3: Tenured or tenure-track core faculty members who are involved in teaching and/or supervision in other graduate program(s) in addition to being a core member of the graduate program under review.

Category 4: Non-tenured or tenure-track core faculty members who are involved in teaching and/or supervision in other graduate program(s) in addition to being a core member of the graduate program under review.

Home Faculties:

FBIT: Faculty of Business and Information Technology
FEAS: Faculty of Engineering and Applied Science
FESNS: Faculty of Energy Systems and Nuclear Science

Some of the faculty members (H. Gabbar, L. Lu) hold cross-appointments between the Faculty of Engineering and Applied Science, and the Faculty of Energy Systems and Nuclear Science.

UOIT is a relatively new university, so the number of professors participating in the MEngM program is expected to increase over the coming years. Table 2-2 shows the plan for a new core faculty hire in engineering management in 2011/2012. In addition, faculty members hired in the future for other UOIT engineering programs may be eligible to participate in the MEngM program.

Table 2-2: Planned Faculty Hiring in Engineering Management for the Years 2010 to 2012

Home Unit[1]	Year	Total Number
FEAS	2010/2011	0
FESNS	2010/2011	0
FEAS	2011/2012	1
FESNS	2011/2012	0

1

FEAS: Faculty of Engineering and Applied Science
FESNS: Faculty of Energy Systems and Nuclear Science

2.2 External operating research funding

Table 2-3 presents the external research funding that professors in the three participating Faculties (FEAS, FESNS, FBIT) have received since 2003. This represents only confirmed funding, and it will increase as professors successfully secure additional funding in the future. In this eight year period, the professors who will participate in the proposed new program have secured a total of $7,930,720 in research funding.

Table 2-3: Operating Research Funding by Source and Year				
	Source			
Year	Granting Councils[1]	Other Peer Adjudicated[2]	Contracts[3]	Others[4]
2003	281,520	168,220	0	240,000
2004	138,790	116,265	43,000	276,000
2005	268,970	285,910	81,000	291,000
2006	184,087	77,400	137,000	223,600
2007	275,270	577,165	151,830	77,250
2008	776,660	622,539	50,000	130,000
2009	608,087	490,179	49,502	107,000
2010	414,486	617,930	128,060	42,000
Totals	2,947,870	2,955,608	640,392	1,386,850

Faculty members are actively applying for additional funding from the Natural Sciences and Engineering Research Council of Canada (NSERC), the Canadian Foundation for Innovation (CFI), AUTO21, Ontario Centres of Excellence (OCE), and the Ministry of Research and Innovation (MRI), among others. In addition, professors are active in securing research funding through industry contracts. As the number of faculty increases over the next few years, it is anticipated that the funding figures in Table 2-3 will increase substantially.

[1] *NSERC, SSHRC, CFI, CIHR, CRC, Japanese Government*

[2] *OCE, ORF, PREA – Research Excellence, AUTO 21, Canada Space Agency, MMO, MDI, Canadian Council on Learning, AIF, Ontario Power Authority, ORF/AECL/UOIT, OCE/Marnoch Thermal Power Inc/Ontario Power Authority, OME, Environment Canada, Ontario Partnership for Innovation & Commercialization*

[3] *Marnoch Power Inc., Oil & Gas, UAE, Qatar University, Durham Regional Police Services, Public Health Agency of Canada, SABIC Innovative Plastics, Zephyr Alternative Power Inc., AECL. MITACS*

[4] *UOIT Start-up Grants, Okayama University Research Support, UTRC, Canadian Patient Safety institute*

2.3 Graduate supervision

Table 2-4 lists the completed and current numbers of thesis supervisions by faculty members in FEAS, FESNS and FBIT. The table shows a balance of senior professors, who have successfully graduated numerous students, and early career professors, who have not yet graduated students.

Table 2-4: Completed and Current Numbers of Thesis Supervisions by Faculty Member

	Completed			Current		
Member	**Master's**	**PhD**	**PDF**	**Master's**	**PhD**	**PDF**
Category 3						
A. Barari	0	0	0	2	0	0
G. Bereznai	2	0	0	0	0	0
I. Dincer	18	11	21	17	9	5
H. Gabbar	24	3	1	3	0	0
B. Goodman	0	0	0	0	0	0
A. Grami	1	0	0	0	1	0
M. Ham	1	0	0	3	0	0
G. Harvel	4	1	0	6	0	0
S. Karray	0	0	0	0	0	1
H. Kishawy	13	1	0	2	3	0
L. Lu	3	0	1	4	1	0
R. Machrafi	1	0	0	5	1	0
J. Percival	0	0	0	3	0	0
I. Pioro	0	0	0	1	0	0
B. Reddy	7	1	4	5	1	0
M. A. Rosen	25	1	6	8	6	2
C. Surti	0	0	0	0	0	0
D. Zhang	5	2	2	7	2	0
Category 4						
M. Bennett	27	2	0	0	0	0
V. Quan	2	0	0	0	0	0

A number of the faculty involved in the proposed program also hold adjunct professor appointments at other universities. Table 2-5 outlines these adjunct appointments.

Table 2-5: Adjunct Appointments	
Member	**University – Department**
Category 3	
A. Barari	University of Western Ontario - Department of Mechanical and Materials Engineering
I. Dincer	Carleton University – Department of Mechanical Engineering University of Toronto – Department of Mechanical and Industrial Engineering University of Waterloo – Department of Mechanical Engineering
A. Grami	Ryerson University – Department of Electrical and Computer Engineering York University
M. Ham	Queen's University - Mechanical and Materials Engineering Department WPI - Mechanical Engineering Department
G. Harvel	McMaster University – Department of Engineering Physics McMaster University - Department of Mechanical Engineering
J. Percival	University of Waterloo – Department of Management Sciences, Faculty of Engineering
B. Reddy	University of New Brunswick, Fredericton - Department of Mechanical Engineering,
M. A. Rosen	Ryerson University – Department of Mechanical and Industrial Engineering University of Western Ontario – Department of Mechanical Engineering
D. Zhang	University of Saskatchewan - Department of Mechanical Engineering
Category 4	
M. Bennett	University of Western Ontario
V. Quan	Ryerson University – Department of Mechanical and Industrial Engineering

2.4 Current and recent teaching assignments – FEAS, FESNS, FBIT

Tables 2-6, 2-7, and 2-8 show teaching loads for faculty members in the proposed program for the academic years 2010-11, 2009-10, and 2008-09 respectively.

Table 2-6: Teaching Assignments for 2010/2011

Faculty Member	Rank	Undergraduate	Graduate
Category 3			
A. Barari	Assistant	ENGR 2310U Concurrent Engineering & Design ENGR 4060U Automotive Structural Design & Materials Selection ENGR 4999U Supervision of Capstone Projects	ENGR 5011G Advanced Engineering Design
G. Bereznai	Professor and Dean of Faculty of Engineering & Applied Science and Faculty of Energy Systems and Nuclear Science		
I. Dincer	Professor	ENGR 2320U Thermodynamics ENGR 3260U Introduction to Energy Systems ENGR 3930U Heat Transfer	
H. Gabbar	Associate	ENGR 3350U Control Systems ENGR 4730U Reactor Control ENGR 2970U Electric Circuits	NUCL 5275G Safety Instrumented Systems
B. Goodman	Associate	RESEARCH LEAVE	
A. Grami	Associate	ENGR 2110U Discrete Math ENGR 3130U Communication Systems INFR 3710U Systems & Random Signals ENGR 3070U Probability & Random Signals	
M. Ham	Assistant	ENGR 4380U Life Cycle Engineering ENGR 4045U Quality Control	
G. Harvel	Associate	ENGR 4700U Nuclear Plant Design and Simulation ENGR 4780U Nuclear Reactor Design ENGR 4520U Nuclear Plant Safety Design ENGR 4994U Undergraduate Thesis Part I	NUCL 5260G Reactor Containment Systems
S. Karray	Associate	BUSI 3230U Marketing Channels BUSI 3260U Marketing Research	BUSI 5200G Marketing Management
H. Kishawy	Professor	ENGR 2220U Structure & Properties of Materials ENGR 2430U Dynamics	

L. Lu	Assistant	ENGR 4660U Risk Analysis Methods ENGR 2790U Electric Circuits ENGR 3740U Scientific Instrumentation	NUCL 4270G Control, Instrumentation and Electrical Systems in CANDU based Nuclear Power Plants
R. Machrafi	Assistant	RADI4430, Industrial Application of Radiation techniques ENGR3530, Safety and Quality Management ENGR3570, Environmental Effect of Radiation	NUC5310, Transmutation of Nuclear Waste
J. Percival	Assistant	BUSI 3040U Information Systems (Fall and Winter)	BUSI6090G Special Topics in Business - Discrete Event Simulation Modeling BUSI5500G Information Systems Management
I. Pioro	Graduate Program Director, PhD/MASc/MEng in Nuclear Engineering and Graduate Diplomas in Nuclear Technology		
B. Reddy	Associate	ENGR 4240U Applied Thermal & Fluids Engineering ENGR 4410U Fossil Fuel Energy Conversion ENGR 4430U Sustainable & Alternative Energy Technologies ENGR 4231U Thermofluids & Energy Systems Design II	ENGR 5141G Heat Exchanger Design & Analysis
M. A. Rosen	Professor	ENGR 4450U Thermal Environmental Engineering	Pollution Prevention and Sustainable Engineering (special topics course)
C. Surti	Assistant	BUSI 2603U Intro to Operations Management	BUSI 5600G Operations and Project Management
D. Zhang	Associate		ENGR 5261G Advanced Mechatronics: MEMS & Nanotechnology
Category 4			
M. Bennett	Lecturer and Associate Dean, FEAS	ENGR 3360U Engineering Economics ENGR 4760U Ethics, Law, & Professionalism for Engineers	
V. Quan	Lecturer	ENGR3190U Manufacturing and Production Processes ENGR4390U Modelling Manufacturing Systems ENGR3300U Integrated Manufacturing Systems ENGR4015U Reliability & Maintenance ENGR3460U Industrial Ergonomics	ENGR5221G Computer-Integrated Manufacturing

Table 2-7: Teaching Assignments for 2009/2010

Faculty Member	Rank	Undergraduate	Graduate
Category 3			
A. Barari	Assistant	ENGR 4060U Automotive Structural Design & Materials Selection ENGR 4999U Supervision of Capstone Projects ENGR 2860U Fluid Mechanics (2 sections) ENGR 3320U Fluid Power Systems ENGR 3460U Industrial Ergonomics	
G. Bereznai	Professor and Dean of Faculty of Engineering & Applied Science and Faculty of Energy Systems and Nuclear Science		
I. Dincer	Professor	RESEARCH LEAVE	
H. Gabbar	Associate	ENR 4730U Reactor Control ENGR 4045U Quality Control ENGR 3530U Safety & Quality Management ENGR 4994U Thesis Project Design	NUCL 5285G Advanced Process Control Systems
B. Goodman	Associate	BUSI 1450U Business Statistics BUSI 3450U Business Forecasting Techniques	BUSI 5400G Quantitative Analysis in Business BUSI 5450G Business Forecasting Techniques
A. Grami	Associate	ENGR 3130U Communication Systems INFR 3710U Systems & Random Signals ENGR 3070U Probability & Random Signals ENGR 2970U Electric Circuits INFR 3720U Digital Transmission	
M. Ham	Assistant	ENGR 4080U Automotive Systems Design I ENGR 4081U Automotive Systems Design II ENGR 4230U Thermofluids & Energy Systems Design I ENGR 4231U Thermofluids & Energy Systems Design II ENGR 4330U Mechatronics Systems Design I ENGR 4331U Mechatronics Systems Design I ENGR 4380U Life Cycle Engineering	

G. Harvel	Associate	ENGR 4700U Nuclear Plant Design and Simulation ENGR 4780U Nuclear Reactor Design ENGR 4520U Nuclear Plant Safety Design	NUCL 5460G Industrial Radiography
S. Karray	Associate	BUSI 3230U Marketing Channels BUSI 3260U Marketing Research BUSI 4240U Retail Management	BUSI 6090G Special Topics in Business
H. Kishawy	Professor	ENGR 3190U Manufacturing & Production Processes ENGR 4210U Advanced Solid Mechanics & Stress Analysis ENGR 2430U Dynamics (2 sections)	ENGR 5243G Mechanics & Dynamics of Machine Tools ENGR 5005G Special Topics
L. Lu	Assistant	ENGR 3140U Computer Architecture ENGR 2790U Electric Circuits ENGR 3740U Scientific Instrumentation	NUCL 5050G Applied Risk Analysis
R. Machrafi	Assistant	RADI4430, Industrial Application of Radiation techniques ENGR3530, Safety and Quality Management (50%) RADI2110, Health Physics Laboratory RADI2100, Radiological and Health Physics ENGR2950, Radiation Protection	
J. Percival	Assistant	Maternity Leave BUSIN 3040U Information Systems	BUSI 5500G Information Systems Management
I. Pioro	Graduate Program Director, PhD/MASc/MEng in Nuclear Engineering and Graduate Diplomas in Nuclear Technology		
B. Reddy	Associate	ENGR 4240U Applied Thermal & Fluids Engineering ENGR 4410U Fossil Fuel Energy Conversion ENGR 4430U Sustainable & Alternative Energy Technologies ENGR 4231U Thermofluids & Energy Systems Design II	ENGR 5101G Thermal Energy Storage
M. A. Rosen	Professor	ENGR 4450U Thermal Environmental Engineering	ENGR 5161G HVAC and Refrigeration Systems Design and Analysis
C. Surti	Assistant	BUSI 2603U Intro to Operations Management	BUSI 5600G Operations and Project Management
D. Zhang	Associate	ENGR 3220U Machine Design	ENGR 5260G: Advanced Robotics and Automation

M. Bennett	Lecturer and Associate Dean, FEAS	ENGR 3950U Operating Systems ENGR 4800U Advanced Operating Systems ENGR 3360U Engineering Economics ENGR 4760U Ethics, Law and Professionalism for Engineers	
V. Quan	Lecturer	ENGR3190U Manufacturing and Production Processes (2 sections) ENGR4390U Modelling Manufacturing Systems	ENGR5010G Advanced Optimization ME8132 Sequencing & Scheduling (Ryerson U)

Table 2-8: Teaching Assignments for 2008/2009

Faculty Member	Rank	Undergraduate	Graduate
Category 3			
A. Barari	Assistant	ENGR 2260U Statics & Solid Mechanics (2 sections) ENGR 2310U Concurrent Engineering & Design (2 sections)	
G. Bereznai	Professor and Dean of Faculty of Engineering & Applied Science and Faculty of Energy Systems and Nuclear Science	ACADEMIC LEAVE	
I. Dincer	Professor	ENGR 2320U Thermodynamics ENGR 3260U Introduction to Energy Systems ENGR 3930U Heat Transfer	ENGR 5100G Advanced Energy Systems
H. Gabbar	Associate	Okayama University, Japan Artificial Intelligence Engineering Fundamentals UOIT ENGR 2970U Electric Circuits ENGR 3740U Scientific Instrumentation	Okayama University, Japan Computational Intelligence Engineering Technical English (50%) Introduction to Systems Engineering (15%) UOIT NUCL 5275G Safety instrumented Systems NUCL 5360G Emergency Response and Disaster Management NUCL 5110G Reliability and Maintenance Engineering

B. Goodman	Associate	BUSI 1450U Statistics BUSI 2603U Introduction to Operations Management	
A. Grami	Associate	BUSI 1900U (2) Business Math ENGR 3130U Communication Systems INFR 3710U Systems & Random Signals INFR 3720U Digital Transmission INFR 1516U Introductory Calculus	
M. Ham	Assistant	ENGR 4380U Life Cycle Engineering ENGR 4045U Statistical Quality Control ENGR 4060 Automotive Structure Design & Materials ENGR 4080U Automotive Systems Design I ENGR 4081U Automotive Systems Design II ENGR 4760U Ethics, Law and Professionalism for Engineers	
G. Harvel	Associate	ENGR 4520U Nuclear Plant Safety Design ENGR 4700U Nuclear Plant Design & Simulation ENGR 4780U Nuclear Reactor Design	NUCL 5230G Advanced Nuclear Thermalhydraulics
S. Karray	Associate	BUSI 3230U Marketing Channels BUSI 3260U Marketing Research BUSI 4240U Retail Management	
H. Kishawy	Professor	ENGR 3190U Manufacturing & Production Processes ENGR 4210U Advanced Solid Mechanics & Stress Analysis	
L. Lu	Assistant	MATERNITY LEAVE	
R. Machrafi	Assistant	RADI4430, Industrial Application of Radiation techniques RADI4320, Therapeutic Application of Radiation ENGR3530, Safety and Quality Management	RADI5400, Advanced Radiation Science
J. Percival	Assistant	BUSI 1650U External Environment of Management BUSI 3040U Information Systems	
I. Pioro	Associate Graduate Program Director for MASc/MEng in Nuclear Engineering	ENGR 2010U Thermodynamic Cycles ENGR 2860U Fluid Mechanics ENGR 3930U Heat Transfer	NUCL 5240G Heat Transfer in Nuclear Reactor Applications
B. Reddy	Associate	ENGR 4240U Applied Thermal & Fluids Engineering ENGR 4410U Fossil Fuel Energy Conversion ENGR 4430U Sustainable & Alternative Energy Technologies ENGR 4231U Thermofluids & Energy Systems Design II	ENGR 5101G Thermal Energy Storage
M. A. Rosen	Professor	ENGR 4450U Thermal Environmental Engineering	

C. Surti	Assistant	IT IS 197 Data Analysis and Business Modelling wiht MS Office - Brock University BUSI 2603U Intro to Operations Management BUSI 2604U Intro to Project Management and Supply Chain Management	BUSI 5600G Operations and Project Management
D. Zhang	Associate	ENGR 2430U Dynamics ENGR 3220U Machine Design	ENGR 5261G: Advanced Mechatronics: MEMS and Nanotechnology
Category 4			
M. Bennett	Lecturer Associate Dean, Faculty of Engineering & Applied Science	ENGR 3360U Engineering Economics ENGR 3960U Programming Languages & Compilers ENGR 4760U Ethics, Law and Professionalism for Engineers	ENGR 5005G Special Topics – Project Management for Engineers
V. Quan	Lecturer	ENGR3190U Manufacturing and Production Processes ENGR4390U Modelling Manufacturing Systems ENGR3770U Design & Analysis of Algorithms ENGR3300U Integrated Manufacturing Systems ENGR4015U Reliability & Maintenance ENGR3460U Industrial Ergonomics	ME8127 Optimization Models (Ryerson U)

2.5 Commitment of faculty members from other graduate programs and/or from other institutions

All members of FEAS and FESNS are involved in one or more additional graduate programs, namely, the MASc/MEng and, where applicable, PhD programs in Automotive Engineering, Electrical and Computer Engineering, Mechanical Engineering, or Nuclear Engineering.

Drs. B. Goodman, S. Karray, J. Percival and C. Surti are faculty members of the Faculty of Business and Information Technology and they are involved in teaching courses in FBIT's MBA program.

3. PHYSICAL AND FINANCIAL RESOURCES

3.1 Library resources

The University of Ontario Institute of Technology Library enriches the research, learning and teaching carried out by the university through exceptional information services and facilities to support all academic programs.

The construction of a new, state-of-the-art library for the University of Ontario Institute of Technology was completed in the fall of 2004. Designed by internationally renowned Diamond and Schmitt Architects Incorporated, the 73,000-square-foot library serves students, faculty, and staff. The four-storey, $20.7-million library houses individual and collaborative learning spaces, research workstations, electronic classrooms, a reading room and periodicals collection. It offers a variety of learning spaces to suit individual learning styles and user needs. Its design also allows for future enlargement, up to double the original size.

Library collections and accessibility are discussed in detail in Appendix A. Paper copy and electronic resources supporting the Engineering Management graduate program are highlighted. Students and faculty must consult materials from both the Engineering and Business disciplines with respect to journals, transactions, conference proceedings, standards, marketing reports and SWOT analyses. Amongst the key Engineering databases are ASTM Digital Library (American Society of Testing & Materials), Compendex, IEEE (Institute of Electrical and Electronics Engineers), Inspec (Institution of Electrical Engineers), INIS (International Nuclear Information System) and Scitation (AIP – American Institute of Physics & ASME – American Society of Mechanical Engineering) . Primary Business databases include ABI/INFORM Dateline, Business Source Complete, CBCA Complete (Canadian Business & Current Affairs), EconLit, Factiva and Management & Organization Studies: A Sage Full-text Collection. Likewise, the Library offers a significant collection of engineering, business and management books and e-books.

Students and faculty have access to library resources using their wireless laptops, anytime from anywhere. Within the building, patrons can work individually or collaboratively. Digital resources and complementary print collections are available and librarians provide students with the skills needed to navigate effectively through the information environment.

A more detailed presentation on the library resources is provided in Appendix A: Library submission.

3.2 Laboratory facilities

3.2.1 Automotive Centre of Excellence (ACE)

The new Automotive Centre of Excellence (ACE) will open at UOIT in September, 2010. Launched with support from General Motors Canada Limited and the Province of Ontario, ACE will link participating automotive companies, suppliers, automotive engineers, universities, colleges, researchers and students in a new building equipped with state-of-the-art automotive design, engineering and research facilities. ACE will provide graduate students with access to world-class facilities that will be unique in North America.

3.2.2 Borehole Thermal Energy Storage System (BTESS)

The Borehole Thermal Energy Storage System (BTESS) is one of the largest geothermal well fields in the world. Three hundred and eighty-four holes, each 213 metres (700 feet) deep, provide the basis for a highly efficient and environmentally friendly heating and cooling system, capable of regulating eight of UOIT's buildings. The facility contains a large monitoring station for thermal/energy data monitoring and recording. This data will be an excellent source of material for graduate projects and theses in the areas of system analysis, design, optimization, and performance improvement. The geothermal site provides a unique facility within Canada to conduct research into thermal energy storage.

3.2.3 Energy Research Centre (ERC)

A new Energy Research Centre (ERC) is the result of a recent joint $45.4-million investment from both the federal and provincial governments as part of the Knowledge Infrastructure Program. The Centre will be home to UOIT's Faculty of Energy Systems and Nuclear Science and will include administrative space and offices for staff and faculty and an extensive network of teaching and research labs of various configurations and purposes. This includes the research of the Cameco Research Chair in Nuclear Fuels and research that supports the University Network of Excellence in Nuclear Engineering. The facility will have one 50-seat lecture theatre with flexible seating, five 30-seat tutorial rooms, 11 student study rooms and three breakout rooms.

Teaching space within the ERC will be equipped with multimedia capabilities that will provide opportunities to expand the current range of programs, allow future growth in new energy related programs, further develop part-time distance learning opportunities and allow for expansion of the online degree completion that is currently offered.

3.2.4 Research Laboratories

FEAS and FESNS currently have the following research labs:

- Active Vibration Control Laboratory – UA1540 (65 m^2 – Shared)
- Advanced Materials Engineering Laboratory – UA1440 (70 m^2 – Shared)
- Intelligent Robotics and Manufacturing Laboratory – ENG 1050 (65 m^2 – Shared)
- Laboratory for Applied Research on Design and Engineering of Composite Materials – UA1440 (70 m2 – Shared)
- Mechatronic and Robotic Systems Laboratory – UA1460 (65 m^2)
- Nuclear Engineering Laboratory – UA4150 (78 m^2)
- Radiation Engineering Laboratory – UAB408 (45 m^2)
- SHARCNET – UA4280 (70 m^2)
- Sustainable Energy Systems Laboratory – ENG 1050 (90 m^2)
- Clean Energy Research Laboratory – CERL (300 m^2 - Shared)
- Two-Phase Flow Laboratory – UA1420 (78 m^2)

Active Vibration Control Laboratory: This lab is primarily used for research into the areas of adaptive, active and passive vibration control, and dynamic modeling and vibrations of nonlinear machines and flexible structures. The experimental work to be carried out is aimed to verify the vibration suppression of time-varying and parametrically excited dynamic structures through adapting a two-tier alternative: a) system identification to determine the deviations in the structural parameters, and b) a semi-active optimal re-tuning of the absorber elements. In order to show the vibration suppression improvement, initially the primary will be excited by a simple harmonic excitation. Then by changing the frequency of excitation, the effectiveness of the re-tuning procedure is obtained. In addition to the above experimental work, the use of servo-valve controlled pneumatic isolators is studied. Feedback and feedforward signals using displacement and velocity transducers (LVDT) are fed to the control systems to excite the spool valve and in turn adjust the air trapped in the pneumatic system. The aim is to have zero level motion for a sprung mass subjected to a harmonically excited base support.

Advanced Materials Engineering Laboratory: The Advanced Materials Engineering Laboratory conducts research on wood plastic composites and polymer bonding, along with other areas.

Wood Plastic Composites – Wood is one of the most versatile of natural materials with many desirable properties and therefore, its widespread usage as building material is placing strain on the world's forestry resources. The research in this laboratory involves development and production of Wood Plastic Composites (WPC) with improved properties, so that these composites can

replace wood in many applications, thereby helping reduce deforestation rates. The currently produced WPC, due to their inferior properties, are not suitable for many wood replacement applications. This research focuses on improving the properties of WPC by using stronger reinforcing fibres, in conjunction with incorporating a fine cellular structure so that the new composite not only looks and feels like real wood but will have mechanical properties similar to it too. The WPC will be produced on an extrusion processing system capable of using both chemical and physical blowing agents.

Polymer Bonding – This research involves improvement of mechanical properties of plastic parts produced by rapid prototyping systems, with the ultimate goal of manufacturing functional parts instead of 3D models. The parts are produced by fusing particles or filaments of plastics, at elevated temperatures, which are formed layer by layer to build up a 3D part. It entails studying the bond formation due to sintering and diffusion phenomena in polymers and developing predictive models so that new materials and compositions can be evaluated expeditiously with minimum experimentations.

Other Research Areas – Other research interests in the lab are development of production processes and the characterization of new composites, nano-materials, bio-based materials, and foamed materials.

Intelligent Robotics and Manufacturing Laboratory: The Intelligent Robotics and Manufacturing Lab at UOIT has two core research directions: Reconfigurable Manufacturing and Distributed Control. The two core research areas of the lab focus on developing complementary new technologies for flexible manufacturing systems. The objectives of the Distributed Control research are to develop new Internet/Web based distributed intelligent systems to monitor, manage and control production systems. The systems developed will allow manufacturers to reorganise production and process plans dynamically within a shop floor or within a group of shop floors. The objectives of the Reconfigurable Manufacturing research are to develop new production systems that can be reconfigured to optimize utilization of resources. Three themes within the Reconfigurable Manufacturing research are i) the design of new modular reconfigurable machine systems (Reconfigurable Parallel Kinematic Machines), ii) virtual reconfigurable manufacturing systems and iii) modular reconfigurable control.

Laboratory for Applied Research on Design and Engineering of Composite Materials: Cellular and reinforced polymeric and metallic composite materials offer a balance of properties unavailable from other material types. Therefore, their typical applications include satisfying conflicting requirements within the aerospace, automotive, and various other high-performance industrial sectors such as: (i) the need for minimum material usage due to high material costs and weight constraints, and (ii) the need for safe and predictable performance within severe service environments. This research laboratory, led by Dr. Remon Pop-Iliev, focuses on addressing these conflicting requirements through exploring: (i) the design and development of novel composite materials capable of satisfying demanding combined mechanical, chemical, thermal and environmental factors, as well as (ii) the development of innovative processing strategies for their

fabrication. In this context, the laboratory is intended to provide the scientific and engineering foundations for a variety of optimized engineering solutions such as: material selection development, materials qualification and evaluation, materials processing, product design and manufacture, product evaluation, life prediction failure analysis, and disposal recycle reuse analysis.

Mechatronic and Robotic Systems Laboratory: The Mechatronic and Robotic Systems Laboratory conducts research into advanced robotic and mechatronic systems. The laboratory is led by Dr. Scott Nokleby and is affiliated with UOIT's Centre for Engineering, Design, Automation, and Robotics (CEDAR). The lab conducts research into the kinematics and control of complex systems such as joint-redundant manipulators, mobile-manipulator systems, and redundantly-actuated parallel manipulators. Redundant manipulators and mobile-manipulator systems offer numerous advantages over traditional non-redundant systems. Effective utilization of the redundancy inherent in these systems is instrumental in moving the systems from the laboratory and applying them to real-world applications. Research will be conducted using the facilities of CEDAR.

Nuclear Engineering Laboratory: Extensive use of equipment, process and systems simulation is made in support of courses and research. The University has access to several codes used in the design of CANDU type nuclear power plants, as well as real-time simulations that demonstrate operational behaviours under both normal and accident conditions for nuclear power plants that use pressurized and boiling light water reactors, and pressurized heavy water reactors. A variety of virtual operator/machine interfaces are used to conduct plant operations by an individual or team of operators. In addition, the Nuclear Engineering Laboratory conducts research into thermohydraulics modeling, reactor physics modeling, and radiation transport modeling. Equipment planned for the laboratory includes computer racks with a multi-node processing system.

Radiation Engineering Laboratory: The Radiation Engineering Laboratory conducts research into aerosol particle characterization for health physics applications and coded aperture imaging of visually obscured objects. The equipment currently available in the laboratory includes: Malvern Spraytech particle sizer; NIM bins (2) and radiation counting electronics; portable field survey instruments. Additional equipment includes: SAIC RTR-4 Portable x-ray imaging system and electronics; neutron source; and other gamma radiation sources.

SHARCNET: See Section 3.3.

Sustainable Energy Systems Laboratory: Advanced energy systems, ranging from fuel cells to energy storage systems, are now widely used in various sectors. This laboratory conducts research on the analysis, design, modeling, performance improvement, and economic and environmental considerations of these systems. Research activities are concentrated in advanced energy systems and applications as well as alternative energy sources and technologies. The paramount objective is to make such advanced energy systems more efficient, more cost-effective, more environmentally benign and

more sustainable. Some research projects are: energy and exergy analysis of PEM and SO fuel cells; transport phenomena in PEM and SO fuel cells; life cycle assessment of fuel cell vehicles; hybrid energy systems for hydrogen production; energy and exergy analysis of thermal energy storage systems; energy and exergy analysis of crude oil distillation systems; energy and exergy analysis of cogeneration and district heating systems; energy and exergy analysis of wind energy systems; energy and exergy analysis of power plants; energy and exergy analysis of solar thermal systems (e.g., solar ponds); hybrid energy systems for snow melting and freeze protection for highways and bridges; and performance assessment of integrated energy systems.

Clean Energy Research Laboratory (CERL): This lab is used to conduct research on hydrogen production, heat engines and nanotechnology. In this laboratory, researchers are working on the world's first lab-scale demonstration of an integrated copper-chlorine cycle of thermochemical water splitting for nuclear hydrogen production. Hydrogen is a clean energy carrier of the future and potentially major solution to the problem of climate change. Using nuclear, solar or other heat sources (such as waste heat from furnaces or industrial plant emissions), the Cu-Cl cycle promises to achieve higher efficiencies, lower environmental impact and lower costs of hydrogen production than any other existing technology. In addition, research in CERL is conducted on new types of heat engines for cleaner generation of electricity, including a Marnoch heat engine, and nanotechnology devices for waste heat recovery in automotive, computer, mobile device and other applications..

Two-Phase Flow Laboratory: The Two-Phase Flow Laboratory comprises two major apparatuses: the terrestrial two-phase flow experimental facility and the flight qualified two-phase flow experimental facility. The ground based two-phase flow experimental apparatus is used to study the behaviour of two-phase flow under different orientations and flow conditions. It is a fully automated, closed loop system with vertical upward and vertical downward observation sections, heated test sections, and a 180 degree bend. This facility allows for the study of heat transfer, film thickness, void fraction, pressure drop, and phase distribution properties of terrestrial two-phase flows. A NAC HSV-1000 high speed video camera capable of recording at 500 or 1000 frames per second in colour or black and white is used to record flow regimes and their transitions.

The flight qualified two-phase flow experimental apparatus is used to study the behaviour of two-phase flow in a simulated space environment (microgravity). It is a closed loop system with three main subsystems: 1) Fluid Management: includes the test section, pump/separator, air blower, flow meter, valves, etc.; 2) Thermal Management: includes heat sources, radiator, temperature measurement devices, etc.; and 3) Data Acquisition and Control. This facility is flight qualified for the NASA KC-135 microgravity platform. It can be used to study microgravity heat transfer, film thickness, void fraction, pressure drop, and phase distribution in various geometries. These flows can be studied over a 1.7m development length.

Additional equipment planned for the laboratory includes: circumferentially and volumetrically heated channels; concentric heaters piping; condensers and/or

heat exchangers; manifolds; low-flow meters; pressure and differential transducers; void-fraction meters; thermocouples; and other instruments. The equipment is used to conduct research on natural circulation phenomena under single-phase and two-phase flow conditions in pipes and interconnected piping, manifolds, and heat exchangers.

Communication Networks Laboratory – This lab will focus on the research and development of leading associated networking technologies for the non-real and real-time delivery of multimedia information, through theoretical design and simulation of innovative networking concepts. The facilities in this lab include workstations, protocol analyzers, hardware and software ATM switches, routers, and bridges to assess Voice over IP and Mobile IP performance. It also has equipment to characterize the multimedia traffic in wired and wireless communications networks, with a wide range of traffic attributes and network pricing and resource management, monitoring and tomography, and protocol modeling mechanisms.

Communications and Signal Processing Laboratory – This lab has infrastructure for research in signal processing and telecommunications including wireless systems, MIMO communications, spectral analysis and array signal processing, mobile ad hoc and sensor networks, and also satellite communications and interference analyses for a variety of system payloads and frequency bands. This lab provides an environment for the development of new information- and signal-processing algorithms, from conception to implementation, in software or hardware, including new coding and modulation schemes and access techniques for wire-line (twisted-pair and co-axial cable) and wireless systems using communication and signal-processing tool-sets for information processing applications in dynamically changing environments. The research encompasses theoretical analyses and modeling, computer simulation and hardware prototyping. This will provide state-of-the-art testing, measurement, and proof-of-concept prototyping facilities which include radio transmission and test equipment (up to EHF frequencies), co-processor boards, audio and video equipment, data acquisition hardware, DSP development boards with test and evaluation boards. There are also several standalone or networked, and workstations. Software includes all of the standard programming and AI languages, symbolic algebra systems, word-processors, and various packages specific to telecommunications and signal processing.

Hacker Research Lab (HR-Lab) – This lab is not only used to train students through a hands-on research-based approach, but more importantly enable the faculty members and graduate students to lead research programs in their respective fields of IT security. The lab provides a physical and logical infrastructure to allow for a secured and isolated environment in which security related research can be safely performed. As the lab's configuration is designed to be flexible, it can also be linked to external networks if required. Housed in a room of 100 square meters, the lab consists of four main servers including CISCO routers, switches and tape backup units. These servers act as the gateway to the HR-Lab form the outside world. Other than controlling user access and supporting applications, these servers also serve the purpose of Firewall and virus/content scanning. Behind these servers are eight groups of

equipment. Each group has two servers, one switch, one desktop workstation PC and one laptop workstation PC. Each group can work isolated or linked. When all eight groups are linked together, it provides a large network with 16 servers and more than 32 VLAN. The HR-Lab is also equipped with four CISCO wireless access points and four PDAs for conducting research in wireless networking.

3.2.5 Additional Facilities

The 3,835 m^2 OPG Engineering Building opened in the fall of 2006. The building features 17 state-of-the-art laboratories. Although primarily for undergraduate use, the labs can also be used by graduate students. Graduate students have access to the following shared laboratories:

- Combustion/HVAC Laboratory
- Component Design Laboratory
- Computer Aided Design (CAD) Laboratory
- Control Systems Laboratory
- Electronics Laboratory
- Emerging Energy Laboratory
- Fluid Mechanics/Heat Transfer Laboratories
- Manufacturing Laboratory with CNC and Plastics Processing Equipment
- Mechatronics and Robotics Laboratory
- Microprocessors/Digital Systems Laboratory
- Radiation Laboratories
- Solid Mechanics Laboratory

3.3 Computer facilities

All graduate students have wireless and wired access to library resources, email, and the internet through UOIT's Mobile Learning Environment. In the fall of 2006 UOIT joined the PACE Program – Partners for the Advancement of Collaborative Engineering Education[5]. PACE is a program between GM Canada, Sun Microsystems and Siemens PLM Software that provides state-of-the-art hardware and software for engineering schools. The value of the PACE contribution to UOIT is $35 million. Dedicated engineering computer labs featuring state-of-the-art workstations and software have been established at UOIT through PACE. MEngM students will have full access to the PACE hardware and software located in these labs for their studies.

[5] *Source: PACE web site: http://www.pacepartners.org/*

In addition, UOIT is a member of the Shared Hierarchical Academic Research Computing Network (SHARCNET)[6]. SHARCNET is a High Performance Computing (HPC) institute involving 11 academic institutions in southern Ontario. The purpose of SHARCNET is to provide support for support leading-edge research. MEngM students will also have access to this facility for their projects.

3.4 Space

FEAS is located in the OPG Engineering Building. FESNS is located in UOIT's Engineering and Science Building, but will move into the new Energy Research Centre when it opens in the summer of 2011. FBIT is located in the Business and IT Building.

The current total research space allocated to engineering is ~1,500 m^2. An additional 273 m^2 has been allocated for faculty and graduate student offices.

All offices and research spaces have wired access to UOIT's network. In addition, wireless and wired access is available throughout the Engineering and Science Buildings, as well as the library and other spaces on campus.

Faculty members have private offices with telephone lines. Faculty office space averages 13 m^2 and faculty research space averages ~25 m^2.

Graduate students will have access to shared office facilities and/or research labs. Office space totalling 62 m^2 is currently allocated exclusively to graduate students. There is shared office space available for graduate students who are Teaching Assistants. The majority of graduate students will have their office space within the research laboratory of their respective supervisors.

3.5 Financial support of graduate students

There will be no financial support to students in the masters program in Engineering Management. However, these students may qualify for financial assistance from the following sources:

- Teaching Assistantships – students may be eligible to earn up to approximately $9,500 per year through teaching assistantships.
- Work-Study and Other Forms of Employment-Based Learning will be available.
- Provincial Loan Programs are also available.

[6] *Source: SHARCNET web site: http://www.sharcnet.ca/*

4. PROGRAM REGULATIONS AND COURSES

4.1 Intellectual development and educational experience of the student

The MEngM program enhances the students' intellectual development and educational experience by providing depth of study, breadth, professionalism and a state-of-the-art learning environment during their studies. It provides students with an understanding of the fundamental knowledge prerequisites for the practice of engineering management, including scientific principles, analysis techniques, and design methodologies. It also provides students with the depth of education necessary for successful careers as engineering managers in the public or private sectors or in academia. The MEngM program is designed to develop student's skills in communication, teamwork and professionalism and to prepare them for modern work environments and lifelong learning. Graduate students pursue their career goals through graduate courses that are rigorous, challenging, and supportive.

4.1.1 University Vision, Mission and Values

The mission and values of the university serve as the foundation for all activities at UOIT.

Vision:

- The University of Ontario Institute of Technology is an innovative and market-oriented institution, pursuing inquiry, discovery and application through excellence in teaching and learning, value-added research and vibrant student life.

Mission:

- Provide career-oriented undergraduate and graduate university programs with a primary focus on those programs that are innovative and responsive to the needs of students and employers.
- Advance the highest quality of research.
- Advance the highest quality of learning, teaching, and professional practice in a technologically enabled environment.
- Contribute to the advancement of Ontario and Canada in the global context, with particular focus on Durham Region and Northumberland County
- Foster a fulfilling student experience and a rewarding educational (work) environment.
- Offer programs with a view to creating opportunities for college graduates to complete a university degree.

Values:

- Integrity and respect.
- We will treat each other with dignity, including those with challenges.
- Honesty and accountability.
- Our actions reflect our values, and we are accountable for both.
- Intellectual rigour.
- We strive for excellence and challenge convention.

4.1.2 Academic unit

In keeping with its mission to foster a fulfilling student experience and a rewarding educational (work) environment, UOIT has developed operational and support processes and services to enhance the learning environment for students.

FEAS, FESNS and FBIT provide for graduate students a rigorous education and endeavour to instill in them the attitudes, values, and vision that will prepare them for a lifetime of continued learning and leadership in their chosen careers. In order for students and faculty to engage in scholarship of discovery, application, and integration, UOIT has made every effort to provide state-of-the-art learning resources, including the library, learning technologies, and laboratories. For example, students in the Engineering Management program have access to major equipment and common facilities such as ACE, BTESS, and ERC. Details about these facilities are described in Section 3.2.

As can be seen in Section 2, a team of well qualified faculty has been assembled to develop and deliver a high quality, relevant program and to monitor and support students' academic and professional growth.

In addition, academic support staff and student support services are in place to provide service, guidance and support for graduate students.

4.2 Curriculum and Program Requirements

Program Learning Outcomes

Graduates of the Engineering Management program shall be able to:

1. Demonstrate specialized knowledge and understanding of essential facts, concepts, principles, and theories in the field of engineering management.

2. Recognize and be guided by social, professional, and ethical expectations and concerns involved in projects.

4. Apply the principles of effective data management, information organization, and information-retrieval skills to data of various types.

5. Utilize analytical, methodological, interpretive and expository skills in conducting projects.

6. Apply specific and well-concentrated research on engineering management problems and practice.

7. Critically evaluate advanced information and knowledge and examine their application in engineering management practice.

8. Identify problems and opportunities for system analysis, design, improvement, and optimization.

9. Understand, explain, and solve problems using quantitative and qualitative methods.

10. Appreciate the importance of, and develop the strategies for, further education and lifelong learning.

11. Design and conduct experiments and analyze and interpret experimental data and computational results.

12. Demonstrate effective oral and written communication skills.

14. Develop effective project management and teamwork skills.

15. Apply engineering methods and principles of management to the design, planning and operation of systems of people, materials, information and technology.

16. Interact effectively with personnel from various disciplines to further the aims of an organization.

17. Assume leadership roles in the execution of major projects and business initiatives and manage and direct the policies and activities of an organization, in both the private and public sectors.

18. Manage implementation of new process technologies and product management.

The objectives of the Engineering Management program are achieved through advanced course work, or course work combined with a major project. Each student will develop skills and receive instruction in the various areas of engineering management. Furthermore, each student will have the opportunity to develop the prerequisites for specialized practice of, or for advanced study in, the area of Automotive, Electrical and Computer, Mechanical or Nuclear Engineering, including their scientific principles, analysis techniques, and design methodologies. Learning activities and materials in graduate courses will be carefully designed to ensure that students are exposed to the forefront of engineering theory and management practices.

Courses and scholarly activities such as seminars and presentations have been designed to give students in-depth learning in a technical area of engineering as well as opportunities for advanced development of key professional skills such as communication, teamwork, professionalism, project management, leadership, personal effectiveness, and career management. Throughout the curriculum, learning activities are planned and student progress monitored to ensure that safety, professional guidelines, and ethical responsibilities relevant to engineering management are emphasized.

Learning community

UOIT is committed to providing innovative programs through excellence in teaching and learning, value-added research and "vibrant student life." The Engineering Management program will exemplify this commitment. The physical design of the university environment provides many places and spaces for groups to meet and interact, for academic and social purposes. The technological links available to students ensure that a network of communication and support among students and between students and university resources is established and strengthened during the students' tenure at UOIT. Facilities and personnel are available to support learning and development in all areas – academic, physical, social and emotional.

The student-centred philosophy of UOIT is designed to develop and continually enhance a strong sense of academic community, in which students, faculty, support staff and administrators share ideas and experiences. Graduate courses will have smaller numbers of students facilitating the exchange of ideas. This sense of academic community is further reinforced through a seminar series that brings distinguished speakers from industry to speak on topics concerning engineering management. Other scientific presentations, guest speakers, and research colloquia at UOIT are open to the university community. These are already a part of academic life at UOIT. Recognized experts and leading-edge researchers are invited to present seminars and advise on student and faculty research. UOIT's rich network of industry and academic contacts, as exemplified by the ACE project, provide faculty and students with access to exceptional researchers and professionals.

Scholarly activities

Many courses require students to undertake significant independent and group work, and to organize and provide course project reports. These activities strengthen students' skills in leadership, organization, communication, and professional presentation. Teaching and learning activities are conducted in an environment which supports intellectual debate, allows for critique and constructive feedback, and encourages reflective practice. The academic culture of UOIT is guided by its mission and values. The proposed Engineering Management graduate program reflects our university's values.

4.3 Program regulations

The Engineering Management program is governed by UOIT's Graduate Studies Policies, details of which can be found at http://gradstudies.uoit.ca/EN/main/grad_admininistration/policies_and_procedures.html.

As the program will be administered by the Faculty of Engineering and Applied Science, its additional program regulations are outlined below.

4.4 Part-time studies

To facilitate access to all potential students, part-time studies will be permitted.

4.5 Admission requirements

The minimum admission requirement for the Engineering Management program (both degree and diploma) is completion of an undergraduate degree in engineering at a Canadian university or its equivalent, with a minimum of a B (75%) average in the last two years.

The Admission Selection Committee for the MEng in Engineering Management program will be comprised of representatives from the participating Faculties – FEAS and FESNS.

4.6 Language requirements

All applicants are required to give evidence of their oral and written proficiency in English. This requirement can be satisfied with one of the following criteria:

i) The student's mother tongue or first language is English;

ii) The student has studied full-time for at least three years (or equivalent in part-time studies) in a secondary school or university where the language of instruction and examination was English; or

iii) The student has achieved the required proficiency on one of the tests in English language acceptable to the University of Ontario Institute of Technology (see below).

Recommended Scores - English Language Proficiency Tests (higher scores may be required):

- TOEFL (computer based) 220;
- TOEFL (paper based) 560;
- IELTS 7;
- MELAB 85;
- CAEL 60.

4.7 Distance delivery

The program will not be delivered in a distance delivery manner at the present time. In the future, it is expected that distance/hybrid delivery of parts of the programs will be used where the subject matter permits. Distance delivery of courses will comply fully with Section 31 of the OCGS By-Laws governing distance delivery.

4.8 Degree requirements

For the MEngM-Course option, a student must complete ten courses worth a total of 30 credits. Alternatively, the MEngM-Project option allows students tocomplete seven courses (21 credits) and a research project (9 credits). For both options, students will be required to take three engineering management courses from a core group of courses listed in Table 4.1. Descriptions for all courses are provided in Appendix C.

The maximum time for completion of the program is four years measured from the date the student first registers in the program.

Table 4-1: Proposed Engineering Management Courses (Core Group)

Course	Title
ENGR5410G	**Project Management for Engineers** (note: students can take NUCL 5010G Project Management for Nuclear Engineers as a substitute for this course)
ENGR 5415G	**Foundations of Engineering Management**
ENGR 5420G	**Quality Management**
ENGR 5425G	**Production and Operations Management**
ENGR 5430G	**Energy Systems Management**

Students will be required to take three additional engineering management elective courses from Table 4-2. These are courses in existing graduate engineering programs offered by the FEAS or FESNS relevant for students in Engineering Management.

Table 4-2: Proposed Engineering Management Courses (Electives Group)	
Course	**Title**
ENGR 5010G	**Advanced Optimization**
ENGR 5014G	**Pollution Prevention and Sustainable Engineering**
ENGR 5272G	**Design Engineering Management**
ENGR 5275G	**Design for Product End of Life**
NUCL 5350G	**Regulatory Affairs and Licensing Concepts**
NUCL 5050G	**Applied Risk Analysis**
NUCL 5090G	**Occupational Health and Safety**
NUCL 5275G	**Safety Instrumented Systems**
ENGR 5002G	**MEngM Project (9 cr.)**

MEngM-Course students take four additional engineering electives. MEngM-Project students take one additional engineering elective, plus a major project worth 9 credits. For their engineering electives, students select courses from one of the existing graduate engineering programs offered by the FEAS or FESNS. These include: 1) Automotive Engineering; 2) Electrical and Computer Engineering; 3) Mechanical Engineering; or 4) Nuclear Engineering. Students may substitute engineering electives with additional engineering management elective courses.

Students may take one senior 4th year FEAS or FESNS undergraduate course in lieu of an engineering elective course, provided they have not already taken a similar course during their undergraduate degree and the course is approved by the graduate program director. For MEngM-Course students, a maximum of 3 courses can be taken outside of the program of study, at or external to UOIT, subject to approval by the graduate program director. For MEngM-Project students, the maximum is 2 courses.

Students who have taken undergraduate engineering programs with management or similar options will not be given course reductions. They will follow the same requirements as other students, since the MEngM program is an advanced graduate level degree.

4.9 Graduate Diploma requirements

Students may obtain a Graduate Diploma in Engineering Management by completing two engineering management core courses from Table 4-1, and two engineering management elective courses from Table 4-2. Diploma students will not be permitted to take courses outside of the program of study for program credit, and they also may not take any senior 4th year undergraduate course in lieu of a graduate course.

In the case of mature students who do not meet the MEngM academic requirements for admission, consideration will be given to specialized education, training and experience relevant to the area of diploma studies, as long as the applicants are deemed to have satisfactory preparation to succeed in the program. The Graduate Program Director, upon the recommendation of the Faculty's Graduate Admissions Committee, will make admission recommendations to the Office of Graduate Studies.

While candidates for the diploma program may be admitted with lower academic grade point averages if they can provide other credible evidence of their ability to manage graduate level study, they will still be expected to maintain the same minimum academic standards (B- in each course) as students in the MEngM program.

4.10 Engineering electives graduate course listings

Students must select their engineering elective courses from one of the following graduate programs 1) Automotive Engineering; 2) Electrical and Computer Engineering; 3) Mechanical Engineering; or 4) Nuclear Engineering. Elective course lists for each of these programs are provided in tables 4-3 to 4-6.

Table 4-3: FEAS Mechanical Engineering Graduate Program Courses

Course	Title
ENGR 5004G	Directed Studies
ENGR 5005G	Special Topics
ENGR 5010G	Advanced Optimization
ENGR 5011G	Advanced Engineering Design
ENGR 5012G	Advanced and Smart Materials
ENGR 5100G	Advanced Energy Systems
ENGR 5101G	Thermal Energy Storage
ENGR 5102G	Fuel Cells and Hydrogen Systems
ENGR 5120G	Advanced Fluid Mechanics

ENGR 5121G	**Advanced Turbo Machinery**
ENGR 5122G	**Computational Fluid Dynamics**
ENGR 5140G	**Advanced Heat Transfer**
ENGR 5141G	**Heat Exchanger Design and Analysis**
ENGR 5160G	**Advanced Thermodynamics**
ENGR 5161G	**HVAC and Refrigeration Systems Design and Analysis**
ENGR 5180G	**Advanced Nuclear Engineering**
ENGR 5181G	**Advanced Radiation Engineering**
ENGR 5221G	**Computer-Integrated Manufacturing**
ENGR 5222G	**Polymers and Composite Processing**
ENGR 5223G	**Advanced Manufacturing Processes and Methodologies**
ENGR 5240G	**Advanced Dynamics**
ENGR 5241G	**Advanced Mechanics of Materials**
ENGR 5242G	**Advanced Vibrations**
ENGR 5260G	**Advanced Robotics and Automation**
ENGR 5261G	**Advanced Mechatronics: MEMS and Nanotechnology**
ENGR 5262G	**Manipulator and Mechanism Design**
ENGR 5263G	**Advanced Control**
ENGR 5351G	**Mechanics and Dynamics of Machine Tools**
ENGR 5945G	**Mobile Robotic Systems**

Table 4-4: FEAS Automotive Engineering Graduate Program Courses

Course	Title
ENGR 5004G	**Directed Studies**
ENGR 5005G	**Special Topics**
ENGR 5010G	**Advanced Optimization**
ENGR 5011G	**Advanced Engineering Design**
ENGR 5012G	**Advanced and Smart Materials**
ENGR 5100G	**Advanced Energy Systems**
ENGR 5101G	**Thermal Energy Storage**
ENGR 5102G	**Fuel Cells and Hydrogen Systems**
ENGR 5120G	**Advanced Fluid Mechanics**

ENGR 5121G	**Advanced Turbo Machinery**
ENGR 5122G	**Computational Fluid Dynamics**
ENGR 5140G	**Advanced Heat Transfer**
ENGR 5141G	**Heat Exchanger Design and Analysis**
ENGR 5160G	**Advanced Thermodynamics**
ENGR 5161G	**HVAC and Refrigeration Systems Design and Analysis**
ENGR 5221G	**Computer-Integrated Manufacturing**
ENGR 5222G	**Polymers and Composite Processing**
ENGR 5223G	**Advanced Manufacturing Processes and Methodologies**
ENGR 5240G	**Advanced Dynamics**
ENGR 5241G	**Advanced Mechanics of Materials**
ENGR 5242G	**Advanced Vibrations**
ENGR 5260G	**Advanced Robotics and Automation**
ENGR 5261G	**Advanced Mechatronics: MEMS and Nanotechnology**
ENGR 5263G	**Advanced Control**
ENGR 5300G	**Automotive Engineering**
ENGR 5310G	**Advanced Vehicle Dynamics**
ENGR 5320G	**Automotive Aerodynamics**
ENGR 5330G	**Automotive Powertrains**
ENGR 5340G	**Automotive Noise, Vibrations and Harshness**
ENGR 5350G	**Automotive Materials and Manufacturing**
ENGR 5351G	**Mechanics and Dynamics of Machine Tools**
ENGR 5360G	**Automotive Electronics and Software**
ENGR 5370G	**Automotive Design Engineering**
ENGR 5610G	**Stochastic Processes**
ENGR 5620G	**Digital Communications**
ENGR 5630G	**Statistical Signal Processing**
ENGR 5640G	**Advanced Wireless Communications**
ENGR 5650G	**Adaptive Systems and Applications**
ENGR 5670G	**Cryptography and Secure Communications**
ENGR 5690G	**RF and Microwave Engineering for Wireless Systems**
ENGR 5720G	**Pervasive and Mobile Computing**
ENGR 5750G	**Software Quality Management**

ENGR 5760G	**Software Metrics**
ENGR 5850G	**Analog Integrated Circuit Design**
ENGR 5860G	**Digital Integrated Circuit Design**
ENGR 5910G	**Embedded Real-Time Control Systems**
ENGR 5920G	**Analysis and Control of Nonlinear Systems**
ENGR 5930G	**Adaptive Control**
ENGR 5940G	**Intelligent Control Systems**
ENGR 5970G	**Advanced Power Electronics**

Table 4-5: FEAS Electrical and Computer Engineering Graduate Program Courses	
Course	**Title**
ENGR 5004G	**Directed Studies**
ENGR 5005G	**Special Topics**
ENGR 5010G	**Advanced Optimization**
ENGR 5013G	**Advanced Engineering Mathematics**
ENGR 5605G	**Convex Optimization**
ENGR 5610G	**Stochastic Processes**
ENGR 5620G	**Digital Communications**
ENGR 5630G	**Statistical Signal Processing**
ENGR 5640G	**Advanced Wireless Communications**
ENGR 5650G	**Adaptive Systems and Applications**
ENGR 5660G	**Communication Networks**
ENGR 5670G	**Cryptography and Secure Communications**
ENGR 5680G	**Information Theory**
ENGR 5690G	**RF and Microwave Engineering for Wireless Systems**
ENGR 5710G	**Network Computing**
ENGR 5720G	**Pervasive and Mobile Computing**
ENGR 5730G	**Algorithms and Data Structures**
ENGR 5740G	**User Interface Design**
ENGR 5750G	**Software Quality Management**
ENGR 5760G	**Software Metrics**
ENGR 5770G	**Service Computing**
ENGR 5780G	**Advanced Computer Architecture**
ENGR 5850G	**Analog Integrated Circuit Design**
ENGR 5860G	**Digital Integrated Circuit Design**
ENGR 5910G	**Embedded Real-Time Control Systems**

ENGR 5920G	**Analysis and Control of Nonlinear Systems**
ENGR 5930G	**Adaptive Control**
ENGR 5940G	**Intelligent Control Systems**
ENGR 9545G	**Mobile Robotic Systems**
ENGR 5950G	**Computational Electromagnetics**
ENGR 5960G	**Power System Operations, Analysis and Planning**
ENGR 5970G	**Advanced Power Electronics**
ENGR 5980G	**Advances in Nuclear Power Plant Systems**
ENGR 5985G	**Advanced Power Plant Technologies**
ENGR 5990G	**Utility Applications of Static Converters**
ENGR 5995G	**Grid Integration of Renewable Energy Systems**

Table 4-6: FESNS Nuclear Engineering Graduate Program Courses	
Course	**Title**
ENGR 5004G	**Directed Studies**
ENGR 5005G	**Special Topics**
NUCL 5010G	**Project Management for Nuclear Engineers**
NUCL 5020G	**Mathematical Methods in Nuclear Applications**
NUCL 5030G	**Transport Theory**
NUCL 5040G	**Monte Carlo Methods**
NUCL 5050G	**Applied Risk Analysis**
NUCL 5060G	**Nuclear Concepts for Engineers and Scientists**
NUCL 5065G	**Thermalhydraulics Concepts for Engineers and Scientists**
NUCL 5070G	**Environmental Modelling**
NUCL 5080G	**Advanced Topics in Environmental Degradation of Materials**
NUCL 5090G	**Occupational Health and Safety**
NUCL 5100G	**Nuclear Plant Systems and Operation**
NUCL 5200G	**Reactor Physics**
NUCL 5210G	**Advanced Reactor Physics**
NUCL 5215G	**Advanced Reactor Engineering**
NUCL 5220G	**Fuel Management in Nuclear Reactors**
NUCL 5230G	**Advanced Nuclear Thermalhydraulics**
NUCL 5240G	**Heat Transfer in Nuclear Reactor Applications**

NUCL 5250G	**Power Plant Thermodynamics**
NUCL 5260G	**Reactor Containment Systems**
NUCL 5270G	**Control, Instrumentation and Electrical Systems in CANDU based Nuclear Power Plants**
NUCL 5275G	**Safety Instrumented Systems (SIS)**
NUCL 5280G	**Advanced Reactor Control**
NUCL 5285G	**Advanced Process Control Systems**
NUCL 5290G	**Advances in Nuclear Power Plant Systems**
NUCL 5300G	**Advanced Topics in Radioactive Waste Management**
NUCL 5310G	**Transmutation of Nuclear Waste**
NUCL 5350G	**Regulatory Affairs and Licensing Concepts**
NUCL 5400G	**Advanced Radiation Science**
NUCL 5410G	**Physics of Radiation Therapy**
NUCL 5420G	**Aerosol Mechanics**
NUCL 5430G	**Advanced Dosimetry**
NUCL 5440G	**Advanced Radiation Biophysics and Microdosimetry**
NUCL 5450G	**Advanced Material Analysis**
NUCL 5460G	**Industrial Radiography**
NUCL 5470G	**Nuclear Forensic Analysis**

5. OUTCOMES

Enrolment and graduations

As this is an application for a new program, this section is not applicable.

Employment

Employment records of the graduates from the program will be maintained on an ongoing basis.

Publications

Publication records of the graduates from the program will be maintained on an ongoing basis.

Projected graduate intake and enrolments

Table 5-1 shows the projected graduate student enrolment (both full-time and part-time students) over the next seven years. As the program matures over the years, the planned enrolment in the program is expected to increase.

Table 5-1 Projected Intake and Enrolments:

YEAR	FULL-TIME		PART-TIME		TOTAL ENROLMENT
	Intake	Enrolments	Intake	Enrolments	
2011	5-10	5-10	5-10	5-10	10-20
2012	5-10	10-20	5-10	10-20	20-40
2013	5-10	10-20	5-10	15-30	25-50
2014	5-10	10-20	5-10	15-30	25-50
2015	5-10	10-20	5-10	15-30	25-50
2016	5-10	10-20	5-10	15-30	25-50
2017	5-10	10-20	5-10	15-30	25-50

APPENDIX A: LIBRARY SUBMISSION

LIBRARY SUBMISSION TO ONTARIO COUNCIL OF GRADUATE STUDIES (OCGS) FOR THE MASTER OF ENGINEERING IN ENGINEERING MANAGEMENT (MENGM)

UNIVERSITY OF ONTARIO INSTITUTE OF TECHNOLOGY

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Introduction

This document discusses the Library in terms of the collection and its accessibility with respect to the University of Ontario Institute of Technology's Master of Engineering in Engineering Management. The Collections section describes both paper and electronic resources -- books, indexes, periodicals (journals, magazines, newspapers), librarian recommended websites, and data sets. The Accessibility section addresses the physical presence of the Library, onsite reference assistance, the Library web page www.uoit.ca/library as a 24/7 portal, and interlibrary loan and document delivery.

Collections

The Library's acquisition plan is based on evolving pedagogical needs as determined by the academic faculties. In close liaison with the deans and professors, subject specialist librarians define collection development strategies for the ongoing curriculum-based purchase of resources, as well as for the evaluation and review of existing material.

Books

The Library offers a small but comprehensive print collection. In August 2004, the Library took occupancy of its new building (described below) with 53,000 volumes. There has since been an increase of 25,000 titles for a current total of 78,000 volumes; 9,000 or 11.5% of these resources are engineering titles and 8,000 or 10% of these resources are business titles. The additional space is allowing for the relatively quick expansion of the collection to a target of 160,000 texts. The plan is to increase paper copy holdings by at least 3,000 volumes annually for several successive years with a current projected cost of $400,000 to $450,000 per annum.

In 2004/5, just under $48,000 was invested in engineering books – primarily after the move to the new Library. In 2005/6, it was over $72,000, and for the 2006/7 fiscal year, the sum grew to about $78,000. Investment in engineering texts has continued at approximately $80,000 per year or 20% of the book budget as noted above. Examples of recent graduate level titles purchased include: *Advanced Engineering Mathematics* (Thomson), *Advanced Engineering Fluid Mechanics* (Alpha Science International), *Advanced Engineering Thermodynamics* (John Wiley & Sons), *Advanced Mechanics of Materials and Applied Elasticity* (CRC/Taylor & Francis), *Optimal Design of Complex Mechanical Systems: With Application to Vehicle Engineering* (Springer) and *Advanced Mechanical Vibrations* (Alpha Science International).

While the preference is to acquire standards, reports and conference proceedings in electronic format (see below), this is not always possible or feasible. Selected items from key scientific organizations such as the ASTM (American Society for Testing Materials), the CSA (Canadian Standards Association), the ANSI (American National Standards Institute), the AECL (Atomic Energy of Canada Limited), and the NCRP (National Council on Radiation Protection and Measurements) do appear on the shelves.

From its inception, UOIT has built a reputation on science-based programming in mathematics, physics, chemistry and biology; Library collection development has echoed this. There are now over 12,000 science volumes that also lend support to engineering programs, and these purchases will continue at a steady rate. In 2004/5, the investment was $66,500 – again, contingent on the Library's move to a larger location. In 2005/6, the amount was $128,000. In 2006/7, the amount grew again to $130,000, and it has remained approximately at this annual level over the years.

In 2004/5, just under $61,000 was invested in business books -- primarily after the move to the new Library. In 2005/6, it was over $63,000 with a similar sum for the 2006/7 fiscal year. Investment in business texts has continued at approximately $65,000 per year. Books are readily available on topics such as leadership, strategic planning, accounting and finance, economics, project management, information systems, business ethics, statistics and quantitative analysis, marketing, e-commerce, entrepreneurship, organizational behaviour, and international business including intercultural communication.

Presently there are over 70 books within the collection that specifically involve engineering management perspectives. Amongst these titles are: *Managing Engineering and Technology: An Introduction to Management for Engineers* (Pearson/Prentice Hall), *The Entrepreneurial Engineer* (John Wiley & Sons), *Financial Fundamentals for Engineers* (Butterworth –Heinemann), *Engineering Ethics: An Industrial Perspective* (Elsevier Academic Press), and *Six Sigma for Technical Processes: An Overview for R&D Executives, Technical Leaders and Engineering Managers* (Prentice Hall). While the publication of these types of books is limited, the Library will continue to purchase titles that address engineering management.

Books are selected primarily by Subject Specialist Librarians both directly from noteworthy academic publishers (e.g. Wiley, CRC Press, Sage, Elsevier, Academic Press, Addison-Wesley, Kluwer, Springer-Verlag, Pearson Prentice Hall) and from Blackwell's Book Services, an arrangement that allows for the simultaneous purchase of titles from a wide array of vendors. Faculty and student suggestions are encouraged. Through the purchase of books that focus on qualitative and quantitative research methods, the drafting of research proposals, grant writing, presentation techniques, technical communications, and university teaching, the Library is also addressing the practical information needs of all graduate students.

The numbers given above do not include the 1,750 international nuclear engineering reports acquired through donations and housed in the Library's Special Collections Room. These will prove valuable to Engineering Management candidates focusing on energy issues. Most of these reports were published in the 1970 to 1990 timeframe, but some date as far back as the early 1950s. While Canada is well-represented through national reports such as those published by the Canadian Nuclear Association and Canadian Nuclear Society, materials from the United States, United Kingdom, France, Italy, Sweden,

Australia and other countries and international bodies are also included in this special collection.

The Library's 35,000 e-books are also an integral part of the collection. The current fiscal year has witnessed an investment of approximately $70,000 in this electronic format. Science and engineering titles have been purchased both individually (e.g. *Access Science: McGraw-Hill Encyclopedia of Science and Technology, Encyclopedia of Materials Science and Technology, Kirk-Othmer Encyclopedia of Chemical Technology, Ullmann's Encyclopedia of Industrial Chemistry*) and as database packages (e.g. *Springer's Engineering collection* and *CRC's EngNetbase, ChemNetbase* and *ChemLibNetbase collections*).

Likewise, significant investment in business e-books has been made. Engineering Management faculty and students are directed towards *Springer's Business & Economics collection*, *Books 24 x7* and the *Canadian Electronic Library (Gibson). Books 24 x 7* is comprised of three components – Business Pro offering management, leadership, personnel and other general business titles; Finance Pro comprised of budgeting and accounting books; and IT Pro providing information technology texts. New titles are added and updated (e.g. 1st edition replaced with newly released 2nd edition) on a regular basis. The *Canadian Electronic Library* is largely comprised of online government and organizational reports. Given UOIT's commitment to the laptop university concept, the Library's e-book collection will continue to grow.

Journals, Transactions, Conference Proceedings and Standards:

In addition to the indexing and abstracting tools that the Library provides for 100,000 periodicals (journals, magazines, newspapers) through its electronic databases, 35,000 of these titles are available in full text electronically and 400 in paper. Within this full text total, approximately 3,430 are engineering journals, 4,250 are science journals that provide supporting mathematical, physical, chemical and biological information, and 13,000 are business journals. The Library provides the electronic version of a journal in lieu of the paper copy thus providing access 24/7 for a greater number of patrons both on and off campus. As well, the Library makes every attempt to obtain archival issues of key journals in electronic format. However, older issues are not always available online. Several gifts of archival volumes have already been received and the Library will continue to actively pursue and encourage specific journal donations. Many electronic databases licensed by the Library also offer indexing and/or the full text for technical reports, conference proceedings, standards, country and market research reports, case studies, and/or company and industry profiles including SWOT analyses.

Two charts are provided below. The first one categorizes and then lists alphabetically, UOIT library databases pertinent to Engineering. The second chart repeats this process for Business. Following each chart, financial information and additional explanatory notes are provided. The charts are then linked by highlighting journal information from each set of databases that emphasizes the engineering management disciplines.

Engineering

Extremely Relevant:

ASTM Digital Library (American Society of Testing & Materials)
ASTM Standards (American Society of Testing & Materials)
Compendex
IEEE (Institute of Electrical and Electronics Engineers)
INIS (International Nuclear Information System)
Inspec (IEE- Institution of Electrical Engineers)
Materials Science: A Sage Full-Text Collection
Scitation (AIP – American Institute of Physics & ASME – American Society of Mechanical Engineering)
Science Citation Index Expanded (Part of ISI Web of Science)
Scopus

Very Relevant:

ACM (American Computing Machinery)
ACS (American Chemical Society)
BioOne^
Biosis^
CCOHS (Canadian Centre for Occupational Health and Safety) +
*E-Journals @ Scholars Portal**
IOP (Institute of Physics)
MathSciNet
Proquest Science
PubMed^
RSC (Royal Society of Chemistry)
SPIE (Society for Optical Engineering)
Wilson Applied Science & Technology Abstracts

Relevant (multidisciplinary databases):
Academic Search Premier
Academic OneFile
JStor

+ includes MSDS (Material Safety Data Sheets) and associated Ontario and federal legislation and standards

* journal offerings from numerous vendors including Elsevier (Science Direct), Wiley, Springer, Blackwell, Cambridge searchable through a single interface

^ of particular interest to those enrolled in Advanced Radiation Engineering course

In 2003-4, 2004-5, and 2005-6, the Library provided IEEE and Inspec as engineering specific databases at a cost of $52,000, $58,000 and $66,000, respectively. Given price

adjustments attributed to enrollment increases and the addition of database titles, the 2006-2007 total for those electronic resources categorized above as "Extremely Relevant" is $160,000. The total invested in all UOIT Library databases for the current fiscal year is about $550,000.

When a key journal is not available through a database package, the Library negotiates directly with the publisher for title-by-title access. This has been the case for journals issued by ASME (American Society of Mechanical Engineers) and ANS (American Nuclear Society). As described below, the library maintains a searchable online alphabetical listing of all its periodical titles. These singularly acquired journals are included here as are all the full text journal titles from every UOIT Library database.

Business

Extremely Relevant:

ABI/INFORM Dateline
Business Source Complete
CBCA Complete (Canadian Business & Current Affairs)
EconLit
EIU (Economist Intelligence Unit)
Factiva
Hoover's Company Records
*JStor**
Lexis Nexis
Management & Organization Studies: A Sage Full-text Collection
Scholars Portal+

Newspapers:#

Canada's Heritage (*Globe & Mail* archives)
Canadian Newsstand (Ontario newspapers including the *Toronto Star*)
Factiva (Local, national and international newspapers including the *Globe & Mail*)
Lexis Nexis (American and international newspapers)
Regional Business News (American regional business newspapers)

Very Relevant:

Academic OneFile
Academic Search Premier
CPI.Q (Canadian Periodicals)

Relevant

ACM Digital Library (American Computing Machinery)
CCOHS (Canadian Centre for Occupational Health and Safety)
Communication & Mass Media Complete
Communication Abstracts
Communication Studies: A Sage Full-text Collection

Computer Science Index
Human Resources Abstracts
Public Administration Abstracts
Urban Studies & Planning: A Sage Full-text Collection
Urban Studies Abstracts

*Journal Storage – an archival database

+ journal offerings from numerous vendors including Elsevier (Science Direct), Wiley, Springer, Blackwell, Oxford, Taylor & Francis, Cambridge etc. searchable through a single interface

Newspapers are included as a subset under the "Extremely Relevant" category (*Factiva* and *Lexis Nexis* provide both key business journals and newspapers) as they relay current events and offer differing interpretations of their impact on the business world.

Excluding J-Stor and Scholars Portal which are multidisciplinary databases satisfying the research needs of various programs, the databases identified in the "Extremely Relevant" category cost approximately $56,000 to maintain in the 2006-2007 fiscal year. Given price adjustments attributed to enrollment increases and vendor increases, the cost has risen to baout $62,000 in recent years.

With varying degrees of success, engineering databases can be searched for management articles and business databases can be searched for engineering articles. The best UOIT databases for acquiring full text "cross disciplinary" articles are IEEE and Business Source Complete.

The breadth of engineering as a profession is also emphasized through an examination of *JCR (Journal Citation Reports)* categories and content. JCR is a database that ranks journals by impact factor and indicates which journals are most frequently cited in each field. The UOIT Library provides the majority of the top 50 titles listed under the subject categories of *Engineering, Multidisciplinary; Engineering, Industrial;* and *Operations Research & Management Science.* Sample journal titles include: *Reliability Engineering & System Safety; Probability in the Engineering & Informational Sciences; IIE (Institute of Industrial Engineers) Transactions; Engineering Optimization; Quality & Reliability Engineering International; IEEE Transactions on Industry Applications; IEEE Transactions on Engineering Management; Journal of Engineering & Technology Management*, and *Journal of Product Innovation Management.*

As well, the UOIT Library provides full text access to 47 of the top 50 JCR Business journals with impact factors ranging from 4.254 to 0.403. Amongst the journals included in this ranking are: *Academy of Management Review, Journal of Marketing, Administrative Science Quarterly, Journal of Consumer Research, Strategic Management Journal, Entrepreneurship Theory & Practice, Journal of Environmental Economics & Management, Harvard Business Review, Journal of International Business Studies, Industrial & Corporate Change,* and *International Journal of Electronic Commerce.* In addition to JCR recommended journals, the Library also offers numerous other noteworthy titles

Please note that there are several ways to access electronic journals. UOIT is a member of both OCUL (Ontario Council of University Libraries) and CRKN (Canadian Research Knowledge Network) – the provincial and national university library consortia, respectively, that provide for the effective group purchase and distribution of electronic resources. Scholars Portal and E-Journals at Scholars Portal are OCUL platforms that allow an individual to access a number of databases simultaneously. The UOIT Library also provides subject guides highlighting pertinent indexes and databases, a searchable alphabetical list of all indexes and databases, a searchable alphabetical list of all periodical (journal, magazine and newspaper) titles, and a citation locator that checks for either journal or article availability. Further, cross-referencing amongst databases is provided by a federated search engine or linking software called "Find It @ UOIT". If a patron is searching one database, but the article is available in another, he/she will be redirected to this resource. If the article is not available at UOIT, the option to request an ILL (interlibrary loan) is displayed.

Complete sets of standards issued by ASTM and IEEE are found within their respective databases. As noted above, the Library does maintain a minimal number of standards in paper format. While the ASTM database focuses on materials (e.g. adhesives, plastics, steel, paint, glass) and their properties (e.g. corrosion, fatigue and fracture, flammability), the IEEE database addresses electrical products and related infrastructure (e.g. power substations, satellites, circuits, wireless capabilities). A standard search is by topic or alphanumeric code within both databases; comparisons are provided for the various versions of a standard issued over time.

Refworks and Thesis Databases

The Library purchases books that assist graduate students with their research techniques and the consolidation and presentation of data. Helpful electronic products are also available. Refworks is a software tool that allows for citations to be "harvested" from various periodical databases or imported directly so bibliographies can be easily prepared. The user selects the appropriate bibliographic format (e.g. MLA, APA) and Refworks applies it to the references that have been compiled. The complementary component is Refshare; it allows for bibliographies to be shared amongst colleagues and/or to be used as electronic reserve listings. Students may be directed to an article by their professor and simply authenticate into the Library system.

The Library also provides access to *PQDT (Proquest Dissertations and Theses)* and *Theses Canada Portal.* PQDT is a multidisciplinary international database of more than 2 million theses. Indexing and abstracting is provided from 1861 to the present with full text provided from 1998 to the present. The mission of the Theses Canada Portal is to digitize and consolidate Canadian theses documents into one database. Each product offers interlibrary loan and purchase options for items not yet available in electronic format. As well as housing a paper copy of each UOIT graduate thesis, the Library will facilitate the electronic formatting, access and preservation of UOIT thesis documents. The PQDT and Theses Canada Portal options are being investigated as is D-Space, an institutional repository software program, outlined below.

Internet

While the prevalence and importance of the Internet is recognized, it is also realized that not all information on the Internet is of equal value and/or prominence, and that not all people have equal search skills. The Library, therefore, strives to make staff and students aware of quality web sites appropriate to their Program. Listings of Recommended Web Sites are part of the Library Subject Guides that are prepared with each UOIT program in mind. Available through the Library web site www.uoit.ca/library, these Guides are discussed in detail under "Accessibility". For example, relevant sites posted within the Engineering/Applied Science Guide include: NSERC (Natural Sciences and Engineering Council of Canada), Canadian Patents Database, EEVL (Edinburgh Engineering Virtual Library – Heriot Watt University), efunda (Engineering Fundamentals), Project Euclid (Cornell University), Scirus (Elsevier), IEEE (Institute of Electrical and Electronic Engineers), and IEE (Institute of Electrical Engineers). There is also a Nuclear Subject Guide with reference to web sites such as: CNSC (Canadian Nuclear Safety Commission), CanREN (Canadian Renewable Energy Network), AECL (Atomic Energy of Canada Limited), Canadian Nuclear FAQ, IEA (International Energy Agency) and RadWaste.

Similarly, relevant sites posted within the Business Guide include *Canada Business* (Government of Canada), *Strategis: Canada's Business & Consumer Site* (Industry Canada), *GlobalEDGE* (Michigan State University) and *Wall Street Journal Annual Report Service*. Equally noteworthy are sites such as *Resources for Economists on the Internet* (Department of Economics, State University of New York), *HRM Guide- International Human Resources,* and *BUBL LINK: Marketing Links* (Strathclyde University, Glasgow) found within the business specific Subject Guides of Economics, Human Resources and Marketing respectively.

Data Sets

Access to statistics is provided through the Library's subscriptions to three data sets – E-Stat, DLI (Data Liberation Initiative), and ICPSR (Inter-University Consortium for Political and Social Research). E-Stat is Statistics Canada's educational database including census data and CANSIM (Canadian Socio-economic Management System). The DLI is a far more expansive and comprehensive collection of statistical sets assimilated and maintained by Statistics Canada and offered through the IDLS (Internet Data Library System) hosted by the University of Western Ontario's Social Science Computing Laboratory. ICPSR is the international equivalent of DLI and is hosted by the University of Michigan. Files that relate to manufacturing, labour and the environment will be of interest to Engineering Management graduate students.

D-Space

There are plans to enhance and expand D-Space, an institutional repository system that captures, stores, indexes and preserves digital research material. Indexing and abstracting for the Library's Nuclear Reports Collection is hosted through D-Space; the actual physical and complete documents are stored in the Library's Special Collection Room. D-Space is an open archive initiative (OAI) developed by the Massachusetts Institute of Technology (MIT). Its creators intended D-Space to be an online platform for collaboration amongst colleagues. The UOIT Library therefore plans to launch a version of D-Space that invites

Faculty members and graduate students to post their research findings and papers in an institutional repository.

Accessibility

The Building

The new state-of-the-art, 73,000 square foot Library was opened in August 2004. The design has allowed for the creation of a print/electronic library that accommodates new and emerging technologies without sacrificing the personal warmth of a traditional library. The building offers various types of study and activity spaces to accommodate different learning styles and user needs. Noteworthy features include:

- 500 seats
- 11 group study rooms
- 2 library orientation classrooms
- Silent study and special collections room
- 2 floor round reading room with fireplace
- 160 public computers – wired and wireless
- Photocopier and printer stations on each floor
- Special needs adaptive technology equipment

The Library is currently open for 102.5 hours per week. Students consistently request additional opening hours in the early morning and on Sunday evening.

Reference services are provided by professional librarians for 68 hours per week. Librarians liaise with professors so classes specific to student research topics can be offered, and general information literacy sessions are offered campus-wide throughout the year. Topics such as the research process, Internet site evaluation, and bibliographic citation are addressed. Individual or small group appointments with a librarian are encouraged too.

Library Web Page

The Library web page is available at www.uoit.ca/library and is accessible 24 hours a day, seven days a week. Both a general Library e-mail address and a Reference Desk e-mail are provided as well as telephone information so individuals can leave messages at any time. The Library is also a participant in Knowledge Ontario, a province wide initiative aimed at delivering quality reference resources and services to all citizens. The virtual reference desk component called Ask Ontario is scheduled for launch in 2008. Chat software will be used to instantaneously ask and answer reference questions regardless of time and location; this technology promises to be more effective than e-mail and telephone. Beginning with limited hours and an after-hours e-mail default, the ultimate goal is to make virtual reference a “round the clock” service.

General reference assistance is provided through Library web page sections that explain topics such as computer search techniques, article searching, internet evaluation, and bibliographic citation. Amongst the services outlined are circulation procedures, reserves, and interlibrary loan.

The web page's Subject Guides are both directional and informative. Prepared with each UOIT program in mind, each guide highlights discipline specific books, e-books, periodical indexes and additional electronic resources (e.g. websites). Depending on the subject, there may be links to statistics and data, government information, legislation and legal cases. A "Special Notes for this Subject" section also appears at the beginning of each guide, if the researcher needs to be aware of unique holdings (e.g. special nuclear collection), help sheets, facilities, loan periods, etc.

Interlibrary Loan and Document Delivery

Interlibrary Loan is currently provided free of charge to students, staff and faculty. Individuals have the option of making their requests online or in person. RACER (rapid access to collections by electronic requesting) is a VDX (Virtual Document Exchange) interlibrary loan system implemented in OCUL member libraries. Searches are performed throughout all Ontario university libraries and CISTI (Canada Institute for Scientific and Technical Information). As part of OCUL and the IUTS (Inter University Transit System), the Library now receives book loans in a very reasonable amount of time, and Ariel, an electronic transmission system for periodical articles, allows journal requests to be filled within a few days.

Faculty and students from UOIT may also visit other Canadian university libraries and borrow books (Reciprocal Borrowing Agreement) directly upon presentation of their UOIT photo identification card. Materials may be returned directly to the lending library or may be left at the UOIT Library where they will be returned to the appropriate lending library.

The Library is indeed preparing for the University of Ontario Institute of Technology's graduate degree offerings, and lends its support to the resource and research needs of both faculty and students.

APPENDIX B: ENGINEERING MANAGEMENT PROGRAM SURVEY

Survey of Engineering Management Graduate Programs in Ontario

In Ontario, various forms of graduate programs in engineering management are offered. This appendix provides a brief overview of these other graduate programs. Table C-1 summarizes the different engineering management types of graduate programs in Ontario.

Table C-1: Engineering Graduate Programs in Ontario

University	Programs	Degrees
University of Ottawa	Engineering Management	MEng
Carleton University	Technology Innovation Management	MASc/MEng
McMaster University	Engineering Entrepreneurship and Innovation Engineering and Public Policy	MEEI MEPP
Royal Military College	Defence Engineering and Management	MDEM
Ryerson University	Environmental Applied Sci. and Mgmt. Management of Technology and Innovation	MASc MBA/MMSc
University of Toronto	Engineering and Management	BASc/MBA
University of Waterloo	Management of Technology Management Sciences	MASc MASc/MMSc/PhD

Since September, 2006, Carleton University has offered programs leading to a Master of Applied Science (MASc) and a Master of Engineering (MEng) in Technology Innovation Management. The degrees are intended for experienced engineering professionals who are interested in enhancing their leadership skills in the management of innovation, technology strategy, new product development, and commercialization. The MASc is a thesis-based program with in-class coursework, while the MEng is an Internet-based program where all courses and interaction with professors take place through the Internet.

The master's program in Engineering Entrepreneurship and Innovation (MEEI) at McMaster University aims to promote the commercial success of engineering innovation through a curriculum focused on skills needed by entrepreneurs. The curriculum is augmented with speakers and unique learning modules and case studies that enhance the learning experience for students. To promote a high level of interaction with professors, the program accepts only 20 students in each academic year. Also, a Master of Engineering and Public Policy (MEPP) program at McMaster University is designed to enhance understanding of the public policy process and its effects on technological, social and ecological systems. The curriculum consists of core required courses, focus elective courses, a substantive research paper and an intensive workshop/seminar week.

At the University of Ottawa, the Master of Engineering (MEng) in Engineering Management program develops the knowledge and skills of engineers for the management of people, projects, resources and organizations in technical environments. The MEng program is supervised by a committee, which consists of representatives from the School of Management and the Faculty of Engineering. Students are engaged in research in various areas related to engineering management, such as production and operations management, manufacturing management, reliability and maintainability engineering, human resource management, industrial and technology marketing, technical project management and control, research and development and innovation management. A student enrolled in the program must successfully complete 36 credits of academic work, including 24 credits of core courses, and 12 elective credits which can include a 6-credit research project.

The degree of Master of Defence Engineering and Management (MDEM) at the Royal Military College, Kingston, is offered to students of the Land Forces Technical Staff Program (LFTSP), through the Department of Applied Military Science. This degree is a professional one-year master's degree that consists of professional studies and complementary academic activities to educate officers in the analysis and definition of operational requirements, and the management of the acquisition and in-service support of Army equipment. The area of specialization of the master's program is the application of technology to military systems, and effective and efficient means by which such systems can be procured and supported.

At Ryerson University, master’s degrees are offered in Environmental Applied Science and Management (MASc), Management of Technology and Innovation (MBA, MMSc), Master of Business Administration (MBA) in the Management of Technology and Innovation, and Master of Management Science (MMSc) in the Management of Technology and Innovation. The overall objectives of these programs are to train graduates with a strong understanding of the theoretical foundations of management and their application to technology in organizations, as well as how technology and innovation are affected by organizations. Students gain an understanding of the effective use and management of technology to support organizational objectives, within and beyond traditional organizational boundaries.

The Jeffrey Skoll MBA Program at the University of Toronto brings together in a synergistic integrative manner, studies in Engineering and Management. The Program was created to provide a fast track to a productive career as a technological entrepreneur, as a manager or executive in a technology-based business, or more generally as a technology-aware manager in any modern business. The Skoll Program aims to produce graduates with the management skills, comfort with new and emerging technology, and interpersonal and team skills needed to succeed in business.

The Department of Management Sciences, University of Waterloo, within the Faculty of Engineering, grants the following graduate degrees: Master of Applied Science (MASc), Master of Management Sciences (MMSc) and Doctor of Philosophy (PhD). The MASc is obtained through coursework and the completion of a thesis, whereas the MMSc is obtained primarily through coursework, either full-time or part-time through a Management of Technology Online option, MMSci Online.

APPENDIX C: COURSE DESCRIPTIONS

Engineering Management Courses (Core Group)

Course Title: ENGR 5410G: Project Management for Engineers

Course Description and Content Outline: This course prepares engineers in the application of project management to their work. It covers the following topics of engineering project management: project integration, project scope, cost management, time management, engineering quality, human resources, project communications, risk management and procurement management. The course uses the Project Management Institute's PMBOK (Project Management Body of Knowledge) and expands that coverage with relevant examples from nuclear, software and other fields of engineering. Special emphasis is placed on Risk Management, particularly in the area of safety-critical engineering projects. The graduate will be well-positioned both to apply the knowledge in their area of engineering and to write the PMI's PMP examination.

Delivery Mode and Teaching Method(s): This one-term course will be delivered in 3 hours of lectures per week.

Student Evaluation: There will be quizzes, assignments, a final project and a final exam. The weights will be 10%, 20%, 25% and 45% respectively.

Resources to be purchased by students: N/A

Textbook requirements: None

Learning Outcomes: Students who successfully complete the course have reliably demonstrated the ability to:

- understand the engineering project management context
- explain how to control cost overruns and scope of engineering projects
- compute shortest time to complete engineering projects
- explain how to avoid risk of engineering project failure

Course Designer/Developer: Michael Bennett, PhD, PEng, PMP

Faculty eligible to teach the course: Michael Bennett, Vinh Quan

Faculty qualifications required to teach/supervise the course:
PhD degree in engineering and relevant experience in teaching and research

Classroom and equipment requirements: Standard computer enabled UOIT classroom equipped with VCR, DVD, data projectors, and wired and wireless internet access.

Course Title: ENGR 5415G: Foundations of Engineering Management

Course Description and Content Outline: Fundamentals of engineering management. Managerial accounting: cost-volume-profit analysis, costing systems and standard costs, activity based costing, relevant costing. Organizational behaviour: motivation, stress management, effective leadership, communication, work teams. Quantitative decision making in engineering: scoring models, AHP, decision trees, mini-max regret and other strategies.

Delivery Mode and Teaching Method(s): This one-term course will be delivered in 3 hours of lectures per week.

Student Evaluation: Assignments 20%, term project 30%, final exam 50 %

Textbook requirements: None

Learning Outcomes: Students who successfully complete the course have reliably demonstrated the ability to:

- perform product and job costing of engineering projects
- assign overhead cost using different methods
- describe ways to motivate employees and to be an effective leader of engineers
- make decisions quantitatively for complex engineering projects
- use decision trees to structure decisions for best solution

Course Designer/Developer: Vinh Quan, PhD, FEAS

Faculty eligible to teach the course: Vinh Quan, Marnie Ham, and “faculty to be hired”

Faculty qualifications required to teach/supervise the course:
PhD degree in engineering and relevant experience in teaching and research

Classroom and equipment requirements: Standard computer enabled UOIT classroom equipped with VCR, DVD, data projectors, and wired and wireless internet access

Course Title: ENGR 5420G: Quality Management

Course Description and Content Outline: Quality engineering and management evolution, definitions, concepts and principles. Topics include philosophy of quality, quality engineering and management tools; statistical process control, and engineering statistics.. Managing quality process and running quality based projects.

Delivery Mode and Teaching Method(s): This one-term course will be delivered in 3 hours of lectures per week.

Student Evaluation: Assignments/case study 20%, term project(s) 30%, final exam 50%

Textbook requirements:
Introduction to Statistical Quality Control, 6th Edition, Douglas C. Montgomery, John Wiley & Sons, Inc.
Managing, Controlling and Improving Quality, Montgomery, Jennings and Pfund.

Learning Outcomes: Students who successfully complete the course have reliably demonstrated the ability to:

- employ quality engineering management tools
- understand how to develop and implement a quality management program
- set up the tools needed for a quality management program
- gain the tools needed to lead a quality project
- effectively design engineering work for better quality

Course Designer/Developer: Marnie Ham, PhD, P.Eng, BB, FEAS and Vinh Quan, PhD, FEAS

Faculty eligible to teach the course: Vinh Quan, Marnie Ham, Ahmad Barari, Hossam Gabbar

Faculty qualifications required to teach/supervise the course:
PhD degree in engineering and relevant experience in teaching, research and industry.
Faculty members will normally be registered Professional Engineers.

Classroom and equipment requirements: Standard computer enabled UOIT classroom equipped with VCR, DVD, data projectors, and wired and wireless internet access.

Course Title: ENGR 5425G: Production and Operations Management

Course Description and Content Outline: This course covers the primary tools and methods used in the management of production and operations of engineering systems. Product demand forecasting: moving averages, exponential smoothing; inventory management: economic order quantity, (s,S) policy, (r,Q) policy, news vendor models; dynamic programming models, production planning: linear and integer programming models and solution; Lean manufacturing principles and operations and job scheduling.

Delivery Mode and Teaching Method(s): This one-term course will be delivered in 3 hours of lectures per week.

Student Evaluation: Assignments 20%, term project 30%, final exam 50%

Textbook requirements:
Operations Research: Applications and Algorithms, Fourth Edition, Winston, W.L.; PWS-Kent, 2004, ISBN: 0534380581

Learning Outcomes: Students who successfully complete the course have reliably demonstrated the ability to:

- perform sales forecasts using various forecasting techniques
- manage inventory and product shortages
- understand engineering production planning and resource allocation
- apply lean production principles in their operations
- schedule engineering jobs to be performed

Course Designer/Developer: Vinh Quan, PhD, FEAS

Faculty eligible to teach the course: Vinh Quan, Marnie Ham, and faculty to be hired

Faculty qualifications required to teach/supervise the course:
PhD degree in engineering and relevant experience in teaching and research.

Classroom requirements: Standard computer enabled UOIT classroom equipped with VCR, DVD, data projectors, and wired and wireless internet access.

Course Title: ENGR5430G: Energy Systems Management

Course Description and Content Outline: Effective management of energy systems by monitoring, controlling and optimizing their performance. Concepts and techniques of energy management and conservation. Energy auditing; improving energy utilization in space conditioning; insulation; hot water and compressed air systems; steam distribution systems; energy saving opportunities in fired heaters, boilers, refrigeration and cooling systems; continual improvement and awareness of energy efficiency throughout an organization; cogeneration; trend analysis and annual consumption forecasts to effectively manage energy systems; waste-heat recovery and synthesis of heat and power networks; heat exchanger network optimization.

Delivery Mode and Teaching Method(s): This one-term course will be delivered in 3 hours of lectures per week.

Student Evaluation: Term project 40%, final exam 60%

Textbook requirements: "Energy Management Handbook", 5th/6th Edition, Wayne C. Turner, Fairmont Press Inc., 2005. (ISBN 0-88173-460-8)

Learning Outcomes: Students who successfully complete the course have reliably demonstrated the ability to:

- design and implement a comprehensive energy audit
- perform temperature and equipment scheduling
- design efficient HVAC systems for different applications
- analyze building energy consumption using software packages
- classify insulation and select the best insulation for buildings

Course Designer/Developer: Ibrahim Dincer, PhD

Faculty eligible to teach the course: Ibrahim Dincer, Marc Rosen, Bale Reddy

Faculty qualifications required to teach/supervise the course:
PhD degree in engineering and relevant experience in teaching and research.

Classroom requirements: Standard computer enabled UOIT classroom equipped with VCR, DVD, data projectors, and wired and wireless internet access.

Engineering Management Courses (Electives Group)

Course Title: ENGR 5010G – Advanced Optimization

Course Description and Content Outline: The objective of this course is to understand the principles of optimization and its application to engineering problems. Topics covered include: the steepest descent and Newton methods for unconstrained optimization; golden section, quadratic, cubic and inexact line searches; conjugate and quasi-Newton methods; the Fletcher-Reeves algorithm; fundamentals of constrained optimization theory; simplex methods for linear programming; modern interior-point methods; active-set methods and primal-dual interior-point methods for quadratic and convex programming; semidefinite programming algorithms; sequential quadratic programming and interior-point methods for nonconvex optimization. In addition, implementation issues and current software packages/algorithms for optimization will be covered. Global optimization, including genetic algorithms and simulated annealing, will be introduced.

Delivery mode and teaching method(s): 3 hours of lectures per week.

Student evaluation: assignments: 20%, two major research projects: 80%

Suggested Textbook:

A. Antoniou and W-S Lu, *Practical Optimization: Algorithms and Engineering Applications*, Springer, 2007, ISBN-13: 978-0387711065

Learning outcomes: Students who successfully complete the course have reliably demonstrated the ability to:

- formulate and solve unconstrained and constrained optimization problems
- understand how the major unconstrained, constrained, and global optimization techniques work
- use optimization as a tool for solving engineering design problems

Faculty eligible to teach the course: D. Zhang, Vinh Quan, Scott Nokleby, Shahryar Rahnamayan

Faculty qualifications required to teach/supervise the course:

PhD degree in engineering and relevant experience in teaching and research
Faculty members will normally be registered Professional Engineers

Course Title: ENGR 5014G Pollution Prevention and Sustainable Engineering

Course Description and Content Outline: Industry-environment interactions; pollution prevention; sustainability and sustainable development; sustainable engineering; industrial ecology; environmental impacts and concerns; material and energy budgets, life-cycle assessment, reduction of industrial process wastes (solid, liquid, gaseous); design for environment; design for energy use and efficiency; energy sustainability; industrial applications.

Delivery mode and teaching method(s): 3 hours of lectures per week.

Student evaluation: assignments: 20%, two major research projects: 80%

Suggested Textbook: Industrial Ecology and Sustainable Engineering, TE Graedel adn BR Allenby

Learning outcomes: Students who successfully complete the course have reliably demonstrated the ability to:

- complete a life-cycle assessment
- understand implications of industrial ecology and sustainable engineering
- determine the effect on the environment of products/processes and services

Faculty eligible teach the course: M. Rosen, M. Ham, and B. Reddy

Faculty qualifications required to teach/supervise the course:

PhD degree in engineering and relevant experience in teaching and research
Faculty members will normally be registered Professional Engineers

Course Title: ENGR 5272G Design Engineering Management

Course Description and Content Outline: Design management considers the relationship between engineering design and management and reveals how that relationship contributes to business success. This course seeks to identify and reinforce key challenges in the management of the design of innovative engineering devices, processes, technologies and services. The course studies the interaction between design, business and management in organizations, and how to make the innovative design activity visible in the corporate structure by means of strategic planning. Selected topics include: corporate design strategy, measurement of design value, integration and implementation of design strategy, customer loyalty, brand effects of graphic design, managing the engineering design process, and intellectual property. The course is intended to meet the needs of those undertaking a design management role and those interested in effectively managing the innovative design process.

Delivery mode and teaching method(s): 3 hours of lectures per week.

Student evaluation: assignments: 20%, two major research projects: 80%

Suggested textbook: Thomas Lockwood (Editor) and Thomas Walton (Editor) (2008). Building Design Strategy: Using Design to Achieve Key Business Objectives. (Allworth Press, ISBN-13: 978-1- 58115-653-9; ISBN-10: 1-58115-653-7)

Learning outcomes: Students who successfully complete the course have reliably demonstrated the ability to:

- explain design management strategies relating to corporate businesses
- demonstrate their ability to use the acquired knowledge in hands-on creative case studies and/or miniature and term creative design management projects by individuals and/or groups
- apply innovative design management tools to existing business situations
- be proficient in these skills through a variety of shop projects and in a final exercise that uses a combination of these skills

Faculty eligible to teach the course: Remon Pop-Iliev, Ahmad Barari, George Platanitis, Michael Bennett

Faculty qualifications required to teach/supervise the course:

PhD degree in engineering and relevant experience in teaching and research.
Faculty members will normally be registered Professional Engineers.

Course Title: ENGR 5275G Design for Product End of Life

Course Description and Content Outline: This course is about environmental consciousness, which is rapidly becoming a fundamental product design focus in a variety of industries. Product end-of-life management is a growing problem in all industrialised countries. The progressive shortening of the effective useful life of a product, due to technological obsolescence, causes serious difficulties in ensuring adequate forms of disposal. Selected course topics include: strategies for waste reduction, recycling, energy recovery, waste legislation, end-of-life vehicles, waste electrical equipment, hazardous substances, design process selection guidelines, material selection and trade-offs between product design and product recovery. Disassembly and recycling technologies are used when the product reaches the end of its useful life. Design for Disassembly (DfD) and Design for Recycling (DfR) techniques are studied to provide features early in the design phase, which make it easier to dispose or re-cycle products.

Delivery mode and teaching method(s): 3 hours of lectures per week.

Student evaluation: assignments: 20%, two major projects (one research and one hands-on): 80%

Suggested Textbook: Product Design for Manufacture and Assembly, Boothroyd, Dewhurst and Knight

Additional Literature will be assigned from journals and conferences

Learning outcomes: Students who successfully complete the course have reliably demonstrated the ability to:

- complete a product disassembly and redesign the product to improve the product end-of-life
- understand the impacts of end-of-life on changes in a design
- complete a partial SLCA based on changes to end-of-life

Faculty eligible to teach the course: M.Ham

Faculty qualifications required to teach/supervise the course:

PhD degree in engineering and relevant experience in teaching and research
Faculty members will normally be registered Professional Engineers

Course Title: NUCL5310G Regulatory Affairs and Licensing Concepts

Course Description and Content Outline:
The course will describe the fundamentals of work in Nuclear Regulatory Affairs. The roles and responsibilities of a regulatory affairs staff will be described in detail. The course will describe the Nuclear Safety Control Act, current regulations, the role of the license, reportability, interface with safety analysis and design, Issues Management and regulatory communications. The course will also compare Canadian Regulatory practice to US and IAEA regulatory practice and the course will also identify the non-nuclear regulations that affect regulatory affairs at a Canadian Nuclear Facility.

Topics include:
- Licensing Concepts
- Roles and Responsibilities of Regulatory Affairs
- Interfaces with Support groups, Management
- Nuclear Safety Control Act
- Nuclear Regulations
- Canada, US, and IAEA Regulatory Practise
- The Operating License
- S-99 Reportability
- Safety Analysis and Impact on Regulation
- Design and Impact on Regulatory Affairs
- Issues Management
- Non-Nuclear Regulations and Impact on Regulatory Affairs

Length in Contact Hours: 3 hours/week, 3 credits

Delivery Mode and Teaching Method(s): This one-term course will be delivered using 3 hours of lectures per week.

Student Evaluation: Assignments, Case Studies, Exams, Oral Presentations, Projects

Literature and Resources to be purchased by students:
A course pack will be available to the students. Students will be required to perform literature searches in texts, handbooks, and journal papers. Excerpts from Nuclear Regulations would be provided as part of the course pack.

Learning Outcomes:
Students who successfully complete the course have reliably demonstrated the ability to:
- identify the regulatory fundamentals
- build an operating license for a nuclear power plant
- identify the key regulations necessary for safe operation
- understand the differences between Canadian and international regulations

NUCL5310G Regulatory Affairs and Licensing Concepts continued....

- understand the roles and responsibilities of either a utility regulatory staff or a regulator

Course designer/developer: G. Harvel, PhD, PEng

Faculty eligible to teach the course: Glenn Harvel and sessional instructor with regulatory affairs experience to be hired

Faculty qualifications required to teach/supervise the course:
PhD in nuclear engineering or physics with experience in nuclear regulatory affairs and licensing.

Classroom and equipment requirements: Standard computer enabled UOIT classroom equipped with VCR, DVD, data projectors, and wired and wireless internet access

Course Title: NUCL 5050G – Applied Risk Analysis

Prerequisite(s): none

Course Description and Content Outline: This course presents principles and methods for assessing and managing technological risks. The following subjects are covered: probability theory; failure rates; availability; reliability; test frequencies; dormant and active systems; initiating events; fault trees and event trees; dual failures; defense in depth; principle of control, cool, contain; accident prevention, mitigation and accommodation; separation and independence; redundancy; common mode events; safety culture; safety analysis techniques; inherent safety features; plant safety systems; probability evaluation for simple systems; quantitative and probabilistic safety assessment; calculation of frequency and consequences of power plant accidents; risk-based decision making; and risk-based regulation. Applications include aerospace, energy, and nuclear systems safety analysis.

Topics include:

- Probability theory
- Modeling of uncertainty
- Parameter estimation
- Reliability and availability
- Fault tree and event tree analysis
- Common Mode Failures
- Probabilistic Safety Assessment
- Risk-based decision making

Length in Contact Hours: 3 hours/week, 3 credits

Delivery Mode and Teaching Method(s): This one-term course will be delivered using 3 hours of lectures per week.

Student Evaluation: Assignments, Exams, Oral Presentations, Projects

Literature and Resources to be purchased by students:
H. Kumamoto and E. J. Henley, Probabilistic Risk Assessment and Management for Engineers and Scientists. New York: IEEE Press, 1996.

Learning Outcomes. Students who successfully complete the course have reliably demonstrated the ability to:

- understand probabilistic risk assessment methodology
- apply fault tree and event tree for risk analysis
- understand risk-informed decision making
- apply risk-informed decision making for maintenance or design
- use related software to perform reliability and safety assessment
- calculate uncertainty in the calculated risk level
- simulate failure propagation

Course designer/developer: L. Lu, PhD

NUCL 5050G – **Applied Risk Analysis continued...**

Faculty eligible to teach the course: L. Lu

Faculty qualifications required to teach/supervise the course:
PhD in engineering, science or mathematics, with experience in applying safety analysis in nuclear power plants or related systems.

Classroom requirements: Standard computer enabled UOIT classroom equipped with VCR, DVD, data projectors, and wired and wireless internet access.

Course Title: NUCL 5090G – Occupational Health and Safety

Course Description and Content Outline: This course explores the often neglected, although highly important, subject of occupational health and safety as it relates to industrial operations and complex processes. Concepts such as hazard avoidance, health and environmental control, machine guarding, electrical hazards and process safety will be discussed. In addition, management and institutional controls for workplace safety will be considered, such as communicating vital information, pre-task briefings and shift turnovers. Case studies and lessons learned from numerous industrial and manufacturing industry accidents will be used to highlight important information.

Topics include:
Why Accidents Happen, or, The Nature of Industrial Failure
- Analysis of Major Technological Disasters
- Occupational Health and Safety Statistics

Common Accident Modes
Concepts of Hazard Avoidance
- Enforcement
- Psychological
- Engineering
- Analytical

Manufacturing and Industry Topics
Buildings & Facilities
Toxic Substances
Ventilation and Air Quality
Noise
Flammables and Explosives
Personal Protection
Fire Protection
Materials Handling & Storage
Transportation of Dangerous Goods
Machine Guarding
Welding
Electrical Hazards
Construction
Ionizing Radiation
Non-Ionizing Radiation
Temperature
Ergonomics
Management
Industrial process safety strategies

Delivery Mode and Teaching Method(s): This one-term course will be delivered using 3 hours of lectures per week.

Student Evaluation: Assignments, Exams, Project

NUCL 5090G – **Occupational Health and Safety continued...**

Textbook Requirements:
C. Ray Asfahl, Industrial Safety and Health Management, Prentice-Hall, 1999.
Custom Handouts

Literature:
H.C. Howlett II, The Industrial Operator's Handbook, Techstar, 1995.
R. Scott, Basic Concepts of Industrial Hygiene, Lewis, 1997.
J. Looker, Disaster Canada, Lynx, 2000.
J.G. Marone and E. J. Woodhouse, Averting Catastrophe, Uni of California, 1986
Health and Safety Acts of Ontario and Canada.

Learning Outcomes: Students who successfully complete the course have reliably demonstrated
the ability to:

- understand the nature of industrial failure
- analyze occupational health and safety statistics
- discuss common accident modes and relate to institutional failure
- understand, analyze and design hazard avoidance strategies
- understand the health and safety concepts of machine guarding, welding, electrical systems and construction
- understand the health and safety concepts of toxic substances, materials handling and storage and transportation of dangerous goods
- understand the health and safety concepts of ionizing and non-ionizing radiation
- understand the health and safety concepts of building health, ventilation, air quality, noise control and temperature
- understand the health and safety concepts of ergonomics and safety management
- determine process strategies for industrial safety

Course designer/developer: E. Waller, PhD, PEng

Faculty eligible to teach the course: E. Waller

Faculty qualifications required to teach/supervise the course:
PhD degree in physics or engineering with experience in occupational health, safety, or industrial hygiene

Classroom requirements: Standard computer enabled UOIT classroom equipped with VCR, DVD, data projectors, and wired and wireless internet access.

Course Title: NUCL 5275G – Safety Instrumented Systems (SIS)

Prerequisite(s): undergraduate courses of radiation, health, and nuclear reactor design

Course Description and Content Outline: Safety is an essential part of nuclear and energy systems. This course covers fundamentals of safety engineering, including safety system design and safety instrumented systems. Safety assessment techniques are used to evaluate failure modes scenarios and to design and validate nuclear safety systems. This is achieved through the review of previous nuclear accidents and possible failure scenarios. Environmental and other external fault scenarios are discussed and assessed to design and validate appropriate safety systems. Students will also design and validate recovery and shutdown systems for disaster and severe accident scenarios, and design safety systems for control of nuclear releases with the analysis of health and environment.

Topics include:

- Introduction to safety systems
- Safety analysis using qualitative and quantitative methods
- Fault propagation analysis and fault modeling
- Analysis of previous nuclear accidents (reactivity, etc.)
- Inherent safety and safety design approaches
- Process control vs. safety control
- Safety system design: SIS, non-SIS, and passive safety systems
- Independent protection layers and layers of protection analysis
- Safety integrity level calculation and verification of nuclear reactor
- Recovery and disaster management systems for nuclear reactors / nuclear power plants
- Safety systems for earthquake, tornado and other external effects
- Safety systems for health and environmental protection

Length in Contact Hours: 3 hours/week, 3 credits

Delivery Mode and Teaching Method(s): This one-term course will be delivered using 3 hours of lectures per week.

Student Evaluation: Assignments, Exams, Oral Presentations, Projects

Representative Text:
Nuclear Safety: Gianni Petrangeli. Elsevier Butterworth-Heinemann, 2006
Control Systems Safety Evaluation & Reliability (2nd Ed.): William M. Goble, ISA, 1998
Safety Instrumented Systems: Design, Analysis and Justification (2nd Ed.): Paul Gruhn and Harry L. Cheddie, 2006

Learning Outcomes: Students who successfully complete the course have reliably demonstrated the ability to:

- understand milestones of safety life cycle
- understand and demonstrate safety design of SIS and non-SIS systems
- understand verification techniques of control system safety

NUCL 5275G – **Safety Instrumented Systems (SIS) continued...**

- understand failure modes of nuclear reactors and nuclear power plants
- understand safety assessment techniques and demonstrate ability to apply to nuclear reactors and nuclear power plants
- understand and analyze nuclear accidents and define suitable counteractions
- understand safety systems, and design considerations to select suitable design alternatives for severe risks in nuclear reactors and nuclear power plants
- understand impacts of containment of toxic and radioactive materials

Course designer/developer: H.A. Gabbar, PhD

Faculty eligible to teach the course: H.A. Gabbar, Ghaus Rizvi, Ahmad Barari, George Platanitis

Faculty qualifications required to teach/supervise the course:
PhD in engineering with experience in teaching and research in safety engineering and nuclear process engineering

Classroom requirements: Standard computer enabled UOIT classroom equipped with VCR, DVD, data projectors, and wired and wireless internet access.

Course Title: ENGR 5002G – MEngM Project

Course Description and Content Outline: The MEngM Project provides students with the opportunity, under the supervision of a faculty member, to integrate and synthesize knowledge gained throughout their program of study. The chosen topic will be dependent on the student's area of specialization.

Delivery Mode and Teaching Method(s): N/A

Student Evaluation: Students are required to write a report and give a presentation on their completed project.

Resources to be purchased by students: None

Textbook requirements: None

Learning Outcomes: Students who successfully complete the MEngM project have reliably demonstrated the ability to:

- understand and explain essential facts, concepts, principles, and theories relating to their research topic in the field of engineering management
- recognize and be guided by social, professional, and ethical expectations and concerns involved in projects
- apply principles of effective data management, information organization, and information-retrieval skills to data of various types
- utilize analytical, methodological, interpretive and expository skills in conducting projects.
- Apply specific and well-concentrated research on engineering management problems and practice
- critically evaluate advanced information and knowledge and examine their application in engineering management practice
- understand, explain, and solve problems using quantitative and qualitative methods.
- demonstrate effective oral and written communication skills in the presentation of the project

Identify faculty to teach the course:
All faculty members in the MEng in Engineering Management Program

Faculty qualifications required to teach/supervise the course:
PhD degree in engineering and relevant experience in teaching and research

Classroom requirements: None

Equipment requirements: Dependent on the topic