



Faculty of Engineering
and Applied Science

GRADUATE STUDIES & RESEARCH

Memorial University



Where people and ideas become.

GRADUATE STUDIES AND RESEARCH

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INTRODUCTION

This booklet is intended for potential applicants interested in graduate studies and potential research partners interested in collaboration with the Faculty of Engineering and Applied Science at Memorial University of Newfoundland. A number of factors make the university a special place for graduate study and research. The atmosphere is friendly, the faculty is comprised of a dedicated group of individuals who have a broad range of research interests and the unique maritime environment lends itself to a wide variety of stimulating research projects.

Research in engineering and applied science can lead to profound changes in society, but can also respond to the emerging challenges in our communities. Research areas include engineering design for harsh ocean environments, offshore energy, environmental engineering and sustainability, intelligent systems and automation, autonomous ocean systems, process and maritime safety, sustainable energy, sustainable infrastructure and wireless communication.

Our faculty members are increasingly engaged in major research programs, providing students with unique opportunities to work alongside investigators of prestigious projects.

Over the past 10 years, Memorial's Faculty of Engineering and Applied Science has responded to the challenge of doing meaningful, productive research. In order to be nationally competitive in research and to be able to achieve the strategic vision of the province, the university and the Faculty of Engineering and Applied Science have created conditions that facilitate success in research.

Graduate students are a key part of research teams and an essential part of the innovation chain. There is high demand from industry for highly-qualified engineering graduates, including masters and PhD levels. Most full-time graduate students in thesis-based degree programs receive financial assistantship. An industry internship option is also available for students to spend a portion of their degree program working for a company in the area of their thesis research. In addition, the Engineering Graduate Students Society makes the graduate students' experience enjoyable by offering help to individual students and by organizing social events.

A brief description of graduate courses, current research projects, and general information about the university and its environment are included in this booklet. Further details may be obtained by contacting the associate dean (Graduate Studies) or the associate dean (Research), Faculty of Engineering and Applied Science, or by visiting www.engr.mun.ca/graduate/.

NEWFOUNDLAND AND LABRADOR AND CITY OF ST. JOHN'S



Newfoundland and Labrador is so far east in North America, it has its own time zone. The rugged terrain, amazing vistas and sprawling coastline make it unique – to say the least – and the people here are as unique as the terrain. The proud self-expression, the kindness, the humour, the character, the refreshing approach to life – all in a place so rich in history, its fossils date back half a billion years.

St. John's is our capital and located on the east coast of Newfoundland. It was founded more than 400 years ago, and today is a sophisticated, cosmopolitan and safe city with nearly 200,000 residents. There are lots of things to do in St. John's. Shop on Water Street. Enjoy music on George Street. Hike up Signal Hill. Experience underwater life at the Fluvarium, 'The Rock' at Johnson GEO CENTRE, art at The Rooms or LSPU Hall. Jog the trails to Quidi Vidi Lake, ski in Pippy Park or skate at Mile One Centre. The choices seem endless.

In St. John's it can be windy, rainy, foggy and sunny, seemingly all at once. Winters are mild, with an average temperature of 0°C, and summer temperatures average between 20° and 23°C.

MEMORIAL UNIVERSITY OF NEWFOUNDLAND



The largest university in Atlantic Canada, Memorial offers more than 100 degree programs to a student population of approximately 17,000.

Founded in 1925 as a memorial to Newfoundland's war dead, Memorial University College was elevated to degree-granting status in 1949 as Memorial University of Newfoundland. Today, the university is the largest in Atlantic Canada. Memorial provides excellent undergraduate, graduate and professional programs in virtually all disciplines. With locations in St. John's and Corner Brook in Newfoundland, Happy Valley-Goose Bay in Labrador, the French-owned island of Saint-Pierre and Harlow in England, Memorial is committed to experiential learning. The university's many interdisciplinary programs abound with opportunities for experiential learning, ranging from on-campus employment to work terms around the world.

Outstanding research and scholarship, extraordinary teaching and a focus on community service are the university's hallmarks. Many teaching and research activities reflect our mid-North Atlantic locations; these unique settings and our cultural heritage have led to the creation of highly-regarded academic programs and specialized facilities in areas such as music, linguistics, folklore and human genetics, as well as earth sciences, cold-ocean engineering, rural health care and archaeology. For more information about Memorial University of Newfoundland, please go to www.mun.ca.

FACULTY OF ENGINEERING AND APPLIED SCIENCE

We pride ourselves on being a leader in engineering education, competitive in research and well-connected with industry and the engineering profession. Our undergraduate co-operative programs were among the first in Canada and they are highly respected for educating extremely qualified, enterprising young engineers who graduate with both strong academic and professional backgrounds. All of our undergraduate degree programs have received a six-year accreditation decision from the Canadian Engineering Accreditation Board (CEAB) which places our programs among the very best in Canada. Studying in the Faculty of Engineering, you will be taught by dedicated faculty members who are engaged in exciting engineering research and development projects, many in collaboration with industry and who bring this expertise to the classroom.

ABOUT GRADUATE STUDIES



The graduate programs offered by the Faculty of Engineering and Applied Science have grown tremendously over the past few years, both in terms of student strength and variety of courses and programs.

We offer thesis-based graduate programs both at the master's and doctoral levels in civil engineering, electrical engineering, computer engineering, mechanical engineering, ocean and naval architectural engineering and oil and gas engineering. And, we offer course-based master's programs in computer engineering, environmental systems engineering and management, oil and gas engineering and engineering management.

We have numerous research collaborations among faculty members in our different engineering disciplines, providing considerable opportunities for unique interdisciplinary research topics for our graduate students.

Our programs, our people and our facilities make Memorial University an excellent choice for studying engineering. If you are a creative, imaginative person who would like an education that will prepare you for an exciting career and for lifelong learning, then the Faculty of Engineering and Applied Science at Memorial University has something to offer you.

RESEARCH FACILITIES



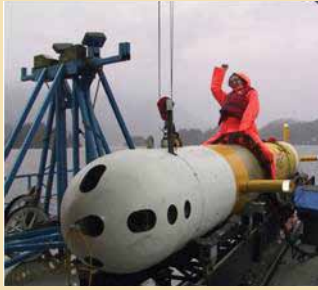
The Faculty of Engineering and Applied Science offers extensive computing, laboratory and workshop facilities with a dedicated technical support staff. Computers, printers, plotters and specialized software are available for the exclusive use of engineering students. All computers are networked, enabling students to access the powerful workstations available in laboratories provided by Engineering Computing Services.

Within the Faculty of Engineering and Applied Science, you will work in exceptional facilities including the Autonomous Ocean Systems Laboratory, the Health, Safety and Risk Research Laboratory, the Manufacturing Technology Centre, the Computer Engineering Research Laboratories, the Environmental Laboratory, the Intelligent Systems Laboratory (ISLab), the Thermo-Fluids Laboratory, Structures Laboratory, a cold room and a 58-metre towing tank.

In addition to in-house laboratory and research facilities, St. John's is home to other acclaimed research centres. Adjacent to the university is the Institute for Ocean Technology (IOT) with its large ice tank, wave tank and sea-keeping basin. Also close by is the Centre for Cold Ocean Research Engineering (C-CORE), which houses a large centrifuge for studying the behaviour of loaded soils. A short drive from Memorial is the Marine Institute, which has a ship simulator and the world's biggest flume tank.



RESEARCH BASED PROGRAMS



M.Eng. students are required to complete four graduate courses, a seminar course and a research thesis, which usually takes two years. The PhD program, which normally takes three years to complete, comprises two courses beyond the master's level and an original research thesis.

Civil



Civil engineering graduate studies may be pursued in many areas, including coastal; geotechnical; structural design and analysis; materials; water resources; hydraulics and hydrology and environmental engineering. Laboratories for studying soils, bitumen, concrete, hydraulics, structures, materials and the environment facilitate student research.

Graduate students in civil engineering can also access specialized facilities including a strength and concrete laboratory and a structural laboratory with a one-metre-thick concrete floor for static and dynamic testing; a hydraulic laboratory with a 58-metre wave/towing tank; environmental laboratories; soil simulator; two wave/soil interaction tanks and a deep tank for acoustic work; an ice structures laboratory with cold rooms and specialized testing equipment; in-house facilities for model fabrication, custom welding and machining services and a geotechnical centrifuge operated by C-CORE.

www.engr.mun.ca/graduate/research/civil.php

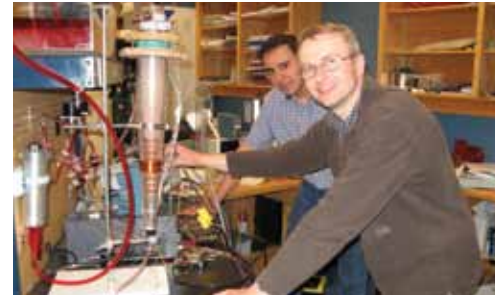
Computer



Computer engineering graduate studies may be pursued in a wide variety of areas, including digital and image processing; software design and verification; error control codes; real-time discrete event systems; multimedia communications; image and video coding; cryptography and digital systems.

www.engr.mun.ca/graduate/research/ComputerEngineering.php

Electrical



Electrical engineering graduate studies are available in a wide variety of areas, including antennas; applied electromagnetics; broadband communications networks; industrial automation; robotics; electric machines; autonomous vehicles; power systems and electronics; wind and alternative energy; distributed power generation; intelligent control; controllers and sensors in harsh environments and wireless communications.

www.engr.mun.ca/graduate/research/electrical.php

Computer and Electrical Engineering

For both computer and electrical engineering, students have access to a wide variety of engineering software for tasks, such as mathematical analysis (MAPLE and MATLAB); electric circuit simulation (SPICE, PSPICE, electronics workbench); VLSI and FPGA design (Synopsys, Cadence and Xilinx) and software design (Rational Rose, Visual Paradigm and Microsoft development tools).

Special facilities include the Instrumentation Control and Automation (INCA) Centre, the Computer Engineering Research Laboratories (made up of the Centre for Digital Hardware Applications Research, the Software Engineering Research Laboratory, the Multimedia Communications and Remote Sensing Laboratory, the Computer-Aided Design Laboratory for Analog and Mixed Signal VLSI Systems) and the Advanced Wireless Communications Research Laboratory (AWCRL) and the Power Devices and Systems Laboratory. In addition, research facilities from industrial and government collaborations are available.

Ocean and Naval Architectural



The ocean and naval architectural engineering program is the only one of its kind in Canada. It is renowned for its unique approach, diverse research projects and exceptional faculty. Graduate studies can be pursued in areas such as marine hydrodynamics, marine structures, underwater vehicles, Arctic engineering and offshore safety and marine simulation. Students have access to a 58-metre towing tank and a structures laboratory with cold rooms and specialized testing equipment.

Research in ocean and naval architectural engineering is complemented by several research groups on campus, providing opportunities for field work and graduate research projects. Memorial University's Ocean Engineering Research Centre (OERC), which is located in the Faculty of Engineering and Applied Science, is involved in research, development and consultation in most areas of ocean engineering, including the offshore petroleum and shipping industries. Scale model experiments, numerical modelling, software development and structural testing are some of the activities within the OERC.

www.engr.mun.ca/graduate/research/naval.php

Mechanical



Students may pursue graduate studies in mechanical engineering in areas such as controls; corrosion; fatigue and fracture mechanics; fluid dynamics; heat transfer; materials; mechanical design; mechatronics; product development; resource utilization; robotics; structural dynamics and vision systems.

Mechanical engineering research facilities include automation and control, computer, fluids, heat transfer and structures laboratories. Specialized facilities include a low-speed wind tunnel, SEM and XRD material characterization equipment, a multiphase flow loop, cold rooms, wave/tow tank, machine vision and x-ray imaging, and a mechatronics laboratory. There is also a manufacturing technology and rapid product development centre. The laboratories are supported by on-site technical services, which include a large machine shop and numerically-controlled machining facilities.

www.engr.mun.ca/graduate/research/MechanicalEngineering.php

Oil and Gas



Graduate studies and research in oil and gas engineering are multidisciplinary to reflect the complexity and multidisciplinary nature of the oil and gas industry. The program is offered by the process engineering discipline with participation from the civil, mechanical, computer, electrical and ocean and naval architectural engineering disciplines. Students in oil and gas engineering may take courses and pursue research in downstream oil and gas processing, environmental protection, risk, reliability and safety engineering, drilling engineering, pipeline engineering, sub-sea geotechnical engineering, reservoir simulation and modelling, green and clean engineering, design of offshore production facilities, compact design of production facilities as well as structural design of offshore structures. Graduates of the program will be safety- and environmentally-conscious engineers, who will contribute towards sustainable engineering development – a priority for the oil and gas, and allied industries.

Research facilities for the oil and gas program include reservoir modelling and simulation laboratories; health, safety and risk; environmental; hydromet processing; corrosion; unit operation; drilling; process modelling and advanced process control and instrumentation laboratories. The university also offers excellent centralized facilities in 3D visualization for reservoir characterization, chemical analysis and exploration.

Research in oil and gas engineering is supported by the oil and gas industries and also by national and provincial research grants. Faculty members in oil and gas engineering have active collaboration with industry and their research is directed towards solving real-life problems.

www.engr.mun.ca/graduate/research/oil_and_gas.php

FAST TRACK OPTION



Students registered in academic Term 7 of a Memorial University of Newfoundland undergraduate engineering program are eligible to apply for admission to the M.Eng. fast-track option. The purpose of the option is to encourage students interested in pursuing graduate studies to begin their research-related activities while still registered as an undergraduate student. Normally, to be considered for admission to the option, students must have achieved at least a 70 per cent average over academic Terms 1 through 6 of their undergraduate engineering program. While enrolled in the option, a student may complete some of the M.Eng. degree requirements and, hence, potentially be able to graduate earlier from the M.Eng. program.

Upon completion of their undergraduate program, students may register in the M.Eng. program on a full-time basis. All courses taken as part of their graduate program while enrolled in the M.Eng. fast-track option are credited towards the M.Eng. degree course credit hour requirements. Courses taken as credit towards a student's undergraduate degree may not be credited towards a student's graduate degree; courses credited towards a student's graduate degree may not be credited towards a student's undergraduate degree.

www.engr.mun.ca/graduate/fast_track.php

INDUSTRIAL INTERNSHIP OPTION



The faculty encourages graduate students to undertake work internships in industry. Internships in industry will permit students either to focus on the practicalities of research projects which have been well defined before the student enters an internship, or to develop and define a research project from problems experienced during the internship. Encouragement to undertake an internship will be given only where it is clear that one of these expectations can be met. Students registered in the M.Eng. program may, with the permission of their supervisor, the dean of the Faculty of Engineering and Applied Science and the dean of the School of Graduate Studies, select the industrial internship option. Students registered in the option must satisfy the degree regulations for the M.Eng. program in addition to requirements specific to the internship option.

“Memorial is a perfect place for contemplative people to do some serious research, and that is unique.”

*Dr. Sathya Prasad Mangalaramanan,
PhD (Memorial University)*

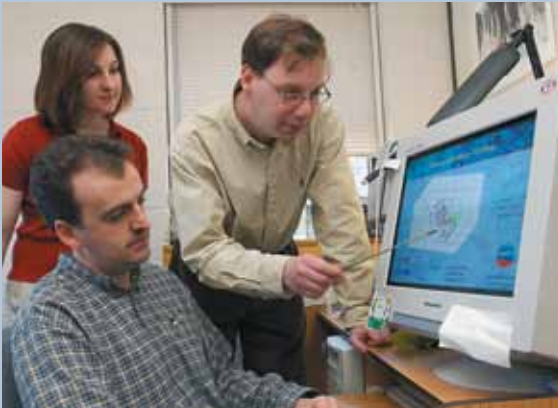


MASTER OF APPLIED SCIENCE (MASc.) DEGREES:



The Faculty of Engineering and Applied Science at Memorial offers course-based programs at the master's level. Students in course-based programs obtain credits towards a master's degree by completing courses only. These courses are taken with other master's and PhD students.

MASc. Computer Engineering



This course-based graduate program prepares its graduates for further post-graduate study or for careers as computer engineers in sectors such as telecommunications, information technology, software development and digital hardware design. The degree provides participants with a balanced background in computer hardware and software and an in-depth knowledge of important application areas such as software development, hardware design, telecommunications systems, computer networks and parallel computing.



MASc. Environmental Systems Engineering and Management



Environmental engineering has become an increasingly important discipline due to the complexity and multidisciplinary nature of environmental issues dealing with human health and ecosystem protection. To find cost-effective engineering solutions to these complex issues, it is important to acquire broad-based education and professional training in inter-disciplinary fields of physical, chemical and biological principles, resource management and mitigation measures besides in-depth knowledge in environmental engineering. This program covers a wide range of related topics, such as environmental law and management; human health and ecological risk assessment; remediation technology; treatment processes of drinking water and wastewater; contaminant transport and environmental modelling; environmental sampling and pollution-control engineering. To apply the concepts learned in the classroom and laboratory environments, students work in teams on an engineering project for two terms. In order to acquire broad-based knowledge in the field, students are encouraged to take courses from other disciplines in the university.

MASc. Oil and Gas Engineering



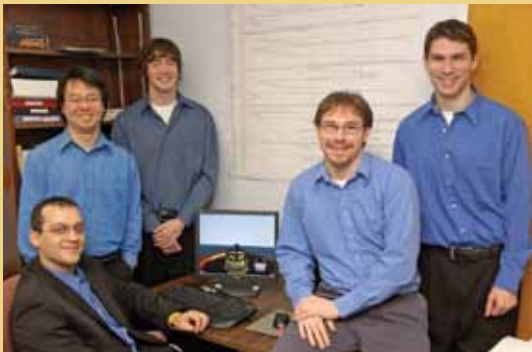
The oil and gas industry is complex and requires expertise in various areas and technical disciplines. To meet this demand, the Faculty of Engineering and Applied Science offers a multidisciplinary program in oil and gas engineering (OGE). The program provides the latest technical knowledge on upstream, production, and downstream aspects of oil and gas engineering. The program also addresses serious issues faced by oil and gas industries, such as sustainable development, environmental protection, risk, reliability and safety. In addition, the program covers drilling engineering, phase behaviour of petroleum fluid, production engineering, compact process equipment design, offshore environmental operations and

natural gas engineering. Many of the courses taught in the program are supported by field study and laboratory demonstrations. To apply the concepts learned in the classroom and laboratory environments, students work in teams on an engineering project for two terms.

Master of Engineering Management



The primary goal of the program is to enable engineering graduates to gain advanced knowledge in their field of engineering and formal training in business, such that they may enhance their participation in their firm's development as part of the current knowledge economy. This course-based master's program combines education in management with technical training in the student's field of interest. The program draws on graduate courses in the faculties of engineering and business. The program can be completed on a full- or part-time basis. The core courses address important engineering management topics such as statistical modelling, organizational behaviour, marketing and accounting applied to decision-making in the engineering sector. Apart from core and elective courses in business and engineering, the program consists of an engineering management project. Issues discussed in courses and projects are geared to be of interest for engineering graduates associated with large companies, small and medium enterprises and start-up organizations.

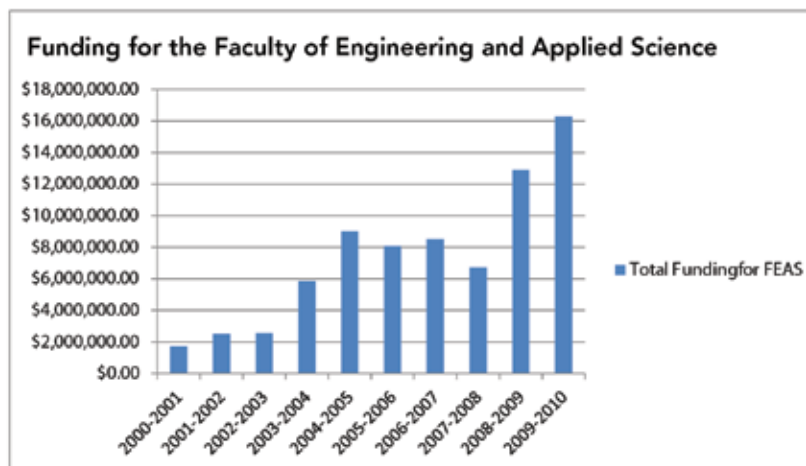


RESEARCH ENVIRONMENT



The Faculty of Engineering and Applied Science recognizes the intimate connection between research and the education of highly qualified people. While research aims to generate new knowledge and new understanding, its application generates economic and social wealth. The innovative application of research to the creation of new products and techniques is usually done in a milieu that combines the efforts of researchers, graduate students and entrepreneurs: the same milieu creates the next generation of innovators and leaders in our society. The research flywheel is powered by new knowledge and passionate people; in turn, it powers innovation and generates wealth.

The faculty's total external research funding has grown over the past 10 years, from approximately \$2 million in 1999-2000 to in excess of \$16 million in 2009-2010. Along with the growth in overall funding has come a growth in graduate student enrolment as well. Graduate students are a key part of research teams and an essential part of the innovation chain.



The faculty is continuously in the process of formulating research programs and the projects that populate them. Research in engineering and applied science can lead to profound changes in society, and can also respond to the emerging challenges in our communities. Some activities for which we have already established a track record follow. These activities fall within Memorial University's strategic areas of oceans, energy and environment, natural resources and information and communications technology.

Engineering for harsh ocean environments. Operations in the ocean and Arctic frontiers require specialist technical knowledge, novel operational techniques and innovative technology. Our long-standing relationship with the North Atlantic is being levered to address the new challenges of operating petroleum installations, vessels of all sorts and subsea systems in these frontier regions. Advanced hydrodynamics and ice engineering will be important for new developments, particularly as industry moves north and into deeper waters, as well as for the safe operation of existing installations. This includes the design of structures, vessels, risers and pipelines that can operate in rough sea conditions and ice conditions.

Offshore energy. Petroleum resource exploration and development is a key part of the provincial economy. The research in the faculty covers all stages of offshore operations from exploration and exploitation through to processing of the petroleum. This includes a focus on ocean engineering and ocean technology, asset integrity in cold and harsh environments, sustainable processing of natural resources, as well as efforts to enhance reservoir recovery rates and reduce drilling technology costs. Other research work in this area is focused on environmental issues, such as those arising from operational impacts associated with discharges of produced water, as well as green process engineering. By its very nature offshore energy requires cross-disciplinary work within the Faculty of Engineering and Applied Science and with other faculties and departments.

Environmental engineering and sustainability. Engineering contributes to environmental sustainability by promoting sustainable, engineered systems that support human well-being and are compatible with natural systems. The faculty has fostered research programs to develop innovative methodologies and technologies to prevent threats and impacts from arising, to protect the environment from threats and damage and to reverse damage already done. The focal areas include clean water supply, integrated water resources management, bioremediation in cold regions, persistent organic pollution control, offshore/mining waste management, decision making under uncertainty, Arctic and Subarctic wetland hydrology, climate change, hydrological modelling, coastal and marine pollution mitigation and risk management.

Intelligent systems and automation. Intelligent systems are likely to have transformative impacts across different sectors. For example, intelligent systems can be used in automating processes in the food industry; they will become increasingly important in applications such as unmanned aerial surveillance, unmanned underground mining and ocean observation missions. Intelligent systems and automation can be brought to bear on issues such as the development of gas off the coast of Labrador in the form of remotely operated petroleum production installations.

Autonomous ocean systems. There is considerable interest in underwater, especially autonomous vehicles and the payloads they might carry. Used as oceanographic research platforms, underwater vehicles can contribute to the development of better ocean circulation models. In the petroleum industry, they can be used to detect and track environmental effects, as well as perform inspection and survey functions. In the Arctic, underwater vehicles can carry out under-ice missions, providing a unique platform for remote access. In addition, in situ ocean monitoring sensors will complement the mobile platforms in the overall ocean monitoring system.

Process and maritime safety. Memorial's Faculty of Engineering and Applied Science has developed strengths in offshore process safety and maritime safety. Process safety, risk management and the design of inherently safer installations and operations are of growing interest worldwide and have the potential to bring significant benefits to the local processing industries. Similarly, while maritime and offshore personnel safety is of special interest to this region, the research work in the faculty is applicable on an international stage.

Alternative energy. Research is ongoing in major areas of alternative energy: hydro power, wind energy and biofuels. Hydro power plays an important part in the provincial and national energy matrix. Wind energy resources have also attracted research efforts, particularly in energy distribution and the integration of power generation.

Sustainable infrastructure. Climate change and energy issues will continue to shape broad social and economic behaviour and policy. The built infrastructure, from road networks to family homes, will be transformed in the next few decades. This transformation will have to be done in the context of sustainable design and operation. This is emerging as a major cross-disciplinary initiative in the faculty, which will help our students – the next generation of engineers – to realize their aspirations for a healthy future.

Wireless communication. Wireless communication is an established research focus and has resulted in the development of the Advanced Wireless Communication Research Laboratory. The laboratory supports research in the emerging multiple-input multiple-output (MIMO), co-operative diversity and cognitive and intelligent radio systems areas. Other efforts in this area have highlighted the investigation of privacy issues surrounding wireless communications. Wireless has a particular application to frontier oil and gas development. The ability to transmit through ice, remote operations, and unmanned systems will require innovative approaches in wireless technology.

One of the goals of Memorial's Faculty of Engineering and Applied Science is to attract and retain top-rate researchers and graduate students at all levels to the faculty.



FACULTY AND RESEARCH AREAS

Adluri, S.M., PhD (Windsor): Structural steel, angle members and towers and connections

Ahmed, M., PhD (Carleton): Wireless and mobile communications

Alam, S., PhD (Saga): Pressure hydrometallurgy, alternative process strategies and environmental management

Bachmayer, R., PhD (Johns Hopkins University): Dynamics, Control, Systems Design, Autonomous Underwater Vehicles (AUV), Underwater Gliders and Remotely Operated Vehicles (ROVs)

Bruneau, S., PhD (Memorial): Ice load on structures, iceberg modelling, wind engineering, micro hydro and micro wind and ocean energy generation systems, energy policy, waste tire management and industrial outreach

Butt, S.D., PhD (Queen's): Geomechanics, drilling, geophysical characterization, non-destructive testing and geostatistics

Chen, B., PhD (Regina): Environmental modelling, pollution control, watershed management, decision support system, petroleum waste management, site remediation and climate change studies

Colbourne, B., PhD (Memorial): Ocean engineering, ice and hydrodynamic loads on ships and offshore structures

Coles, C.A., PhD (McGill): Metal contamination of soils and groundwater, absorption isotherms and bioremediation

Daley, C.G., Dr. Tech. (Helsinki): Arctic naval architecture and ocean engineering

Dobre, O., PhD (Romania): Signal processing and digital communications

Fisher, A.D., B.Sc. (Queen's), M.Eng. (McMaster): Design, lean manufacturing, product development and sustainable systems

George, G.H., PhD (Wales): Engineering education, probability and statistics

Gill, E.W., PhD (Memorial): Theoretical and applied electromagnetic and scattering analysis for random time-varying surfaces

Gosine, R., PhD (Cambridge): Industrial automation, robotics and biomedical engineering

Hassan, A., PhD (Ryerson): Rheological, mechanical and durability properties of self-consolidating concrete (SCC), highlighting the areas of shear, bond and corrosion of the reinforcing bars in concrete

Hawboldt, K.A., PhD (Calgary): Waste gas management and recovery, combustion/pyrolysis of waste gas, oil and gas processing, environmental effects monitoring, offshore produced water and drilling cuttings treatment and disposal

Hawlader, B., PhD (Yokohama): Geotechnical engineering, cold regions engineering, sub-sea geotechnical engineering, centrifuge modelling, soil pipe interactions and constitutive modelling

Heys, H.M., PhD (Queen's): Computer and communications security, cryptology, communications networks and protocols

Hinchey, M.J., PhD (Toronto): Small submersibles, hydrodynamics and icebreakers

Hookey, N.A., PhD (McGill): Computational fluid dynamics and heat transfer

Huang, W., PhD (Wuhan): Mapping of oceanic surface parameters via high-frequency ground-wave radar, ocean surface target detection and tracking and wave and current information extraction from ocean clutter using microwave marine navigation radar

Husain, T., PhD (British Columbia): Environmental risk assessment, environmental modelling, air pollution water resources engineering

Hussein, A., PhD (Memorial): Advanced composite materials as reinforcement for concrete structures, testing of concrete under generalized stress conditions and constitutive modelling of concrete structures

Hsiao, A.C., PhD (Carnegie Mellon): Engineering management and advanced materials

Imtiaz, S.A., PhD (Alberta): Process control, multivariate statistical monitoring and data mining

Iqbal, M.T., PhD (Imperial College): Wind energy, distributed power generation and instrumentation and control

James, L.A., PhD (Waterloo): Enhanced oil recovery, transport in porous media and mass transfer

Jeyasurya, B., PhD (New Brunswick): Power system optimization, power system stability and computational intelligence applications

Johansen, T., PhD (Oslo): Reservoir engineering, mathematical modelling of fluid flow in wells and porous media, integration of simulators for fluid flow, up-scaling of reservoir properties and enhanced oil recovery

Kenny, S., PhD (Dalhousie): Cross-country pipeline design

Khan, F.I., PhD (Pondicherry): Safety and risk engineering, reliability modelling and human health risk assessment

Krouglicof, N., PhD (Concordia): Mechatronics and machine vision

Li, C., PhD (Memorial): Multicast switch fabric design for broadband packet switching networks and digital hardware

Lobo, L.J., M.A.Sc. (Waterloo): Moulding polymers and machines and neural nets

Lye, L.M., PhD (Manitoba): Environmental statistics, statistical hydrology, design of experiments and water resources engineering

Mann, G., PhD (Memorial): Robotics and controls

Masek, V., PhD (Electro-Communications, Tokyo): Instrumentation and control, smart sensors and robotics

Moloney, C.R., PhD (Waterloo): Digital image and signal processing

Munaswamy, K., PhD (Madras): Corrosion, offshore structures and stress analysis

Muzychka, Y., PhD (Waterloo): Heat transfer, thermal design and optimization, two phase flow, fluid dynamics and process flow

Niefer, R., PhD (Windsor): Applied mathematics

Norvell, T.S., PhD (Toronto): Programming methodology and languages and formal methods

O'Young, S., PhD (Waterloo): Real time discrete-event systems, hybrid systems industrial automation, formal methods, robust control and computer-aided control system design

Peng, H., PhD (Dalhousie): Marine hydrodynamics, wave modelling and wave-structure interaction

Peters, D., PhD (McMaster): Requirements specification for real-time systems, automated testing and software design documentation techniques

Qiu, W., PhD (Dalhousie): Ship and offshore hydrodynamics

Quaicoe, J.E., PhD (Toronto): Power electronics and applications, harmonic and voltage compensation and power quality and drives

Rahman, M.A., PhD (Carleton): Electric machines, power systems protection, power electronics, drives, bearingless systems and intelligent controls and applications

Rideout, G., PhD (Michigan): Modelling and simulation and vehicle dynamics

Seshadri, R., PhD (Calgary): Mechanical and structural integrity evaluation procedures for oil and gas production facilities, inelasticity, elevated temperature design, robust simplified methods, codes and standards

Sharan, A.M., PhD (Concordia): Robotics, rotor dynamics and CAE

Shirokoff, J., PhD (Queen's): Materials interface science and engineering and characterization of materials

Snelgrove, K.S., PhD (Waterloo): Hydrology and water resources, climate change, drought evolution and remote sensing

Vardy, A., PhD (Ottawa): Visual robot navigation and biologically-inspired computing

Veitch, B., Dr. Tech. (Helsinki): Ocean and naval architectural engineering and maritime safety

Venkatesan, R., PhD (New Brunswick): Parallel processing architectures and applications, broadband communication and fault-tolerant computing

Walker, D., PhD (Memorial): Underwater vehicles and performance evaluation

Yang, J., PhD (Tianjin University, China): Ocean wave energy conversion, nonlinear dynamics

Zhang, B., PhD (Regina): Environmental system analysis, pollution control and biotechnological engineering

Zhang, L., PhD (Germany): VLSI design automation, analog and mixed-signal integrated circuit design, digital system and circuit design, computer-based instrumentation, microelectronics and computer applications in biomedical engineering and computer peripheral

Zhang, Y., PhD (Singapore): Mass transfer, downstream processing and compact process equipment design

ADMISSION REQUIREMENTS



Admission is limited and competitive. Applicants should have a second class bachelor's degree in engineering or a relevant area from a recognized university.

Applications can be submitted online at www.mun.ca/become/graduate/apply. The application deadline for fall admission is Nov. 1 of the previous year. Applicants from institutions where English is not the language of instruction must include proof of English proficiency. Most students begin studies in September. Applicants who wish to enter programs at other times are considered on an individual basis.

FELLOWSHIPS, SCHOLARSHIPS AND AWARDS

Fellowships and scholarships are available to master of engineering and PhD students. A few entrance scholarships are available to students in professional engineering programs. Students applying to engineering graduate programs will be automatically considered for fellowship and scholarships.

STUDENT AFFAIRS AND SERVICES



At Memorial, you'll find state-of-the-art facilities and first-rate services. The Queen Elizabeth II Library is equipped with the latest technology and some of the best holdings in Atlantic Canada, and is ranked by *Maclean's Magazine* as one of Canada's best university libraries.

Then there's student support. From Student Affairs and Services to our graduate student union (GSU), you'll have access to countless programs and services on campus and throughout the city. The International Student Advising Office helps

students make a successful transition to university life. It provides immigration advice, health insurance information, employment advice, housing tips and assistance with the transition into Canadian culture. It also co-ordinates the airport pickup program, ensuring that students are greeted upon arrival in St. John's.

If the St. John's campus is a community, the Smallwood Centre is the town square. Here you'll find medical care, a pharmacy, stores, a food court, study corners and hangouts. From the bookstore to career and wellness centres, there's almost nothing you can't find here.

Newfoundland and Labrador has one of the lowest crime rates in North America and our campus security team, along with programs like Walksafe and Drivesafe, helps keep it that way.

STUDENT HOUSING



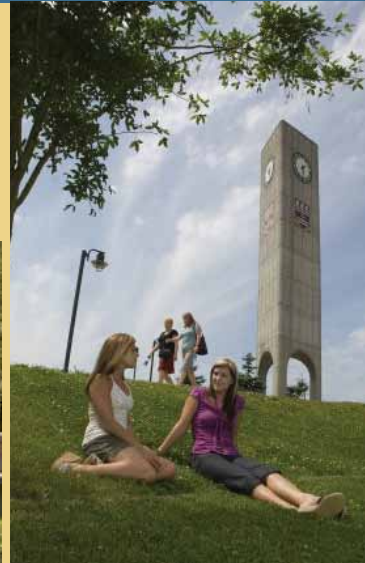
Burton's Pond Apartments, the preferred choice among graduate students, consists of four buildings and offers a more independent, apartment-style way of life. In most of our residences, you'll find television and computer rooms, study spaces, laundry facilities, wireless Internet and best of all, access to the MUNel tunnel system.

Please check out the Off-Campus Housing website at housing.mun.ca/och for help in finding accommodations throughout St. John's and the surrounding area.





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