



Graduate Programs in Engineering

at the University of Alberta

MSc
PhD
MEng



Structural Engineering Synthetic Biology Systems and Control Systems Biology Tailings Management Thermal Conversion
Thermodynamics Thermo-fluids Transportation Engineering Unconventional Oil Recovery Water Quality Management
Water Resources Welding and Joining Wireless Systems Advanced Fuel Cells Aerosols and Particle Dynamics Biochemical
Engineering Biomechanics Biomedical Engineering Carbon Capture and Storage Catalysis and Reaction Engineering
Colloids Communications Computational Intelligence Computer Engineering Construction Engineering and
Management Corrosion and Wear Drug and Gene Delivery Electronic Materials and Devices Energy and the Environment
Energy Systems Engineering Management Environmental Engineering Environmental Remediation Fluid Dynamic
Eostatistics Geotechnical Engineering Information and Communications Technologies Integrated Circuits Interfacial
Engineering Materials Processing Mathematical Modeling Metamaterials Micro- and Nano-Electromechanical System
Micro- and Nanofluidics Mineral Processing Mining Engineering Molecular Sieves Nanoelectronics Nanofabrication

RESEARCH STRENGTHS

Nanotechnology Non-Aqueous
Bitumen Extraction Oil Sands
Tailings Oil Sands Upgrading Petroleum Engineering Petroleum Thermodynamics Photonics and Electromagnetic
Pipelines and Pipeline Transport Plasmas Polymer Engineering Power Electronics and Systems Process Control Ra
Hazards and Safety Renewable Energy Robotics Safety and Risk Management Signal and Image Processing Smart Grid
Software Engineering Solid Mechanics Structural Engineering Synthetic Biology Systems and Control Systems Biolog
Tailings Management Thermal Conversion Thermo-fluids Transportation Engineering Unconventional
Oil Recovery Water Quality Management Water Resources Welding and Joining Wireless Systems Advanced Fuel Cel
Aerosols and Particle Dynamics Biochemical Engineering Biomechanics Biomedical Engineering Carbon Capture and
Storage Catalysis and Reaction Engineering Colloids Communications Computational Intelligence Computer Engineering
Construction Engineering and Management Corrosion and Wear Drug and Gene Delivery Electronic Materials and Device
Energy and the Environment Energy Systems Engineering Management Environmental Engineering Environmental
Fluid Dynamic Eostatistics Geotechnical Engineering Information and Communications Technologies Integrated Circuits Interfacial



Where do you want to go as an engineer?

Graduate school is an investment in your future. In fact, it can make all the difference in the trajectory of your career. An advanced degree is the first step on a career path to leadership positions in technology companies, consulting, research and development organizations, advanced design houses, government, policy development, and academia. Your advanced engineering degree will open doors to exciting challenges as well as professional and personal satisfaction.

The benefits of pursuing graduate studies in the Faculty of Engineering at the University of Alberta

Our students have chosen to make that investment and pursue postgraduate education. They have plans for their careers, and high expectations of their chosen school.

This is what our students say they appreciate most in the Faculty of Engineering:

- Working with highly respected faculty members who publish in prestigious journals and collaborate with international leaders.
- Interacting directly with industry partners, bridging industry and academia and building their professional networks.
- Collaborating on- and off-campus with world leaders in multidisciplinary projects.

- Using state-of-the-art facilities, including world-class resources for nanofabrication, high performance computing, magnetic resonance imaging, patient rehabilitation and surface characterization.
- Having access to significant research funding (greater than \$50M per year) and student financial support (\$19M per year).
- Feeling welcome, safe, and supported in the University of Alberta and Edmonton communities.

These are the underpinnings of the graduate experience awaiting you in the Faculty of Engineering at the University of Alberta.

Greeting innovation with open arms

Katherine Evans (BSc 13) is helping to design a factor system that will give upper-limb amputees the sensation of feeling in their prostheses, allowing them to control their artificial limbs intuitively rather than consciously. Katherine, who is just beginning her MSc under the supervision of Dr. Jason Carey in the Department of Mechanical Engineering and Dr. Jacqueline Hebert in the Division of Physical Medicine and Rehabilitation, will be a member of the interdisciplinary BLINC (Bionic Limbs for Improved Natural Control) project. Through BLINC, experts in rehabilitation medicine, computer science and mechanical engineering are combining surgical rearrangement of existing nerves with innovative myoelectric devices to improve prosthetic function.

Katherine will be building on her significant undergraduate research experience thanks to scholarships from Alberta Innovates – Technology Futures and the Natural Sciences and Engineering Research Council of Canada (NSERC). She has already assisted in the testing of internal composite casts to stabilize broken bones as an NSERC summer student, built an ultrasound-enhanced tipping table for the treatment of scoliosis at the Glenrose Rehabilitation Hospital as a co-op student, and launched a sounding rocket (at the University of Oslo) through the CaNoRock program.

Katherine has chosen to remain in the U of A's Faculty of Engineering for her MSc because she's "not ready to leave the people, resources and interdisciplinary collaborations - yet."

Katherine's enthusiasm is infectious. "My main goal is to be a professor," she says. "I'm really motivated by the opportunity to mentor younger students."



The Faculty of Engineering at the University of Alberta

Engineering

Engineering has been taught at the University of Alberta since 1908. Today, the Faculty of Engineering ranks in the top five per cent of more than 400 engineering schools in North America. This vibrant community of scholars conducts basic and applied research, collaborating extensively with industry and leading international partners. Research conducted here has made Alberta a world leader in a wide variety of fields as varied as oil sands technologies and nanotechnology.

Students in our PhD, MSc and MEng programs will join the largest graduate engineering program in Canada, working with world-renowned scholars who attract over \$50M in research

funding annually. Graduate programs are offered in five departments: Biomedical Engineering, Chemical and Materials Engineering, Civil and Environmental Engineering, Electrical and Computer Engineering and Mechanical Engineering.

Students have the opportunity to work with outstanding faculty (including more than 30 internationally recognized NSERC Industrial Research Chairs and Canada Research Chairs) in state-of-the-art facilities. Since 2001, the Faculty of Engineering has added over one million square feet of new teaching and research space, creating exceptional opportunities for collaboration, learning, professional growth and interdisciplinary research.

Key Research Facilities

NANOFAB An open access micro and nano fabrication research facility with approximately \$60M worth of state-of-the-art fabrication equipment and infrastructure (www.nanofab.ualberta.ca).

NATIONAL INSTITUTE FOR NANOTECHNOLOGY (NINT) A joint venture with the National Research Council Canada (NRC) that hosts world-leading facilities and research programs involving more than 300 researchers (www.nint.ualberta.ca).

ALBERTA CENTRE FOR SURFACE ENGINEERING AND SCIENCE (ACSES) A \$20M multi-disciplinary integrated surface characterization and modification facility (www.ualberta.ca/ACSES).

OIL SANDS TAILINGS RESEARCH FACILITY A facility designed to support substantial fundamental tailings research at a pilot scale (600 and 2000 kg solids per hour) and accommodate multiple, concurrent interdisciplinary research projects (www.ostrf.com).

PETER S. ALLEN MAGNETIC RESONANCE RESEARCH CENTRE A 100 per cent research dedicated, state-of-the-art facility located inside the University Hospital that houses 1.5 T, 3 T and 4.7 T full-body MRI systems (www.invivonmr.ualberta.ca).

WESTGRID A Western Canadian consortium of high-performance computing facilities, including machines with some of the fastest computational speeds in Canada (www.westgrid.ca).

Katherine Evans (left) is excited to start her first graduate-level teaching assignment this fall, and plans to someday teach engineering design. Meanwhile, she will be continuing to supervise high-school students in the WISEST (Women in Scholarship, Engineering, Science and Technology) Summer Research Program and to contribute biomedical content to DiscoverE, the Faculty of Engineering's Engineering, Science and Technology outreach program.

Faculty of Engineering

Key Research Initiatives

INGENUITY - THE NANOTECHNOLOGY ACCELERATOR

A large scale (\$100M), 10-year, multidisciplinary research and development initiative co-located at the University of Alberta, the Faculty of Engineering and the National Institute for Nanotechnology. Ingenuity is focused on groundbreaking bionanotechnology advances and innovative business practices that will enable Alberta to become a world-leading centre for nanotechnology innovation (www.thepowerofn.ca).

CENTRE FOR OIL SANDS INNOVATION (COSI)

A \$50M multidisciplinary research centre focused on developing the oil sands production facility of the future - one that uses little or no water, consumes less energy, occupies less area, integrates upgrading operations and costs less to build and operate (www.cosi.ualberta.ca).



CANADIAN CENTRE FOR CLEAN COAL/ CARBON AND MINERAL PROCESSING TECHNOLOGIES (C⁵MPT)

A research and education centre supporting sustainable and responsible energy and mineral development (www.c5mpt.ualberta.ca).

HELMHOLTZ-ALBERTA INITIATIVE (HAI)

An international research partnership between the Helmholtz Association of German Research Centres (Germany) and the University of Alberta (Canada) to jointly develop solutions to major challenges in fields such as energy and the environment, ecosystem and resource informatics, and health (www.helmholtzalberta.ca).

Zhen Lei (right) is mentored by Dr. Mohamed Al-Hussein, a member of the Hole School of Construction Engineering, which emphasizes industry-oriented graduate student research in the management, industrialization, and strategic modeling of construction. Industry-funded research programs and interdisciplinary collaborations ranging from business to architecture to mathematics combine to create exceptional learning and networking opportunities for graduate students.



Taking on the heavy lifting

Zhen Lei (BSc 09, MSc 11) is developing an automated approach to crane path planning for heavy industry, including the ongoing module-based construction in Alberta's oil sands. Supervised by Dr. Mohamed Al-Hussein (NSERC Industrial Research Chair in the Industrialization of Building Construction) and working closely with PCL Industrial Management Inc., Lei is replacing a tedious and error-prone manual process for lift planning with an automated calculation and visualization methodology. In the words of one industry insider, this project is "taking the construction industry from the 19th to the 21st century."

As a PhD student in the Department of Civil and Environmental Engineering, Lei has benefitted from working with multiple companies in Canada and Germany over the course of his research.

"There is no question in my mind that my post-graduate experience will put me on the fast track to success and leadership in industry," says Lei.

Lei has been a leader in graduate student government since his arrival from China in 2009. Most recently, Lei was the VP Academic for the Faculty of Engineering Graduate Research Symposium. This annual, student-run event features professional development workshops, high-profile invited speakers and more than 100 interdisciplinary presentations from graduate students in all five engineering departments. For students, this event is an opportunity to meet their peers in other departments and broaden their knowledge base.

MSc Graduate Programs in Engineering

All five Faculty of Engineering departments offer MSc and PhD programs

The **MASTER OF SCIENCE (MSc)** is a full-time, research-based degree requiring the completion of a thesis. As an MSc student, you will concentrate on one area of study, developing more advanced skills and knowledge that will benefit you as you enter or re-enter industry.

The **DOCTOR OF PHILOSOPHY (PhD)** is a rigorous, research-oriented degree requiring the completion of a thesis. Taking specialization to the next level, this program builds on your analytical skills and leads to careers in academia or corporate research and development.

Other post-graduate program options

The **MASTER OF ENGINEERING (MEng)** is a course-based degree intended for the working professional and foreign-trained professionals interested in becoming familiar with North American industry. Course content is more applied than in thesis-based MSc and PhD programs and is typically delivered in formats designed to better accommodate working professionals.

The **ENGINEERING MANAGEMENT MEng, MSc AND PhD DEGREES** provide unique graduate opportunities that allow you to broaden your management knowledge and expertise for leadership in technical organizations. Many courses are offered during evening hours to better accommodate working professionals.

The **MBA/MEng** combines advanced engineering knowledge with managerial skills for a competitive advantage in the global marketplace. Students study the key areas of business in Year One and focus on graduate-level courses within the student's engineering discipline in Year Two. An engineering project and a business strategy course complete the program requirements. This degree program is offered jointly with the Alberta School of Business.

The **MASTER OF SCIENCE IN INTERNETWORKING (MINT)** is a two year course-based degree focused on Internetworking leadership training. Course content addresses both theoretical (academic) and

practical aspects of Internetworking in intensive weekend sessions to better accommodate working professionals. This degree program is offered jointly by the Departments of Electrical and Computer Engineering and Computing Science.

The **MD-PhD PROGRAM** allows you to earn both MD and PhD degrees, preparing you for a career as a medical research scientist. To be accepted into this program, you must have already been accepted into the MD Program, and have the approval of the MD/PhD Committee. This combined degree program is offered jointly by Biomedical Engineering and the Faculty of Medicine & Dentistry.

Andrew Walsh (right) believes that access to a dedicated MRI facility offers students the opportunity to make significant discoveries and innovations. "Having almost unlimited access to the MRI systems means individual students can take an idea and move it from development to verification to patient application."



Engineering better patient outcomes

With one foot planted in the world of engineering and the other in medicine, Andrew Walsh (BSc 08, PhD 13) is poised to become a world leader in medical magnetic resonance imaging (MRI). Andrew, an MD-PhD student, recently completed his PhD in Engineering and has now returned to medical school at the University of Alberta. Combining advanced medical training with advanced scientific knowledge, Andrew plans to make an impact in both research and patient care as a clinician scientist.

“It’s like a positive feedback loop,” he explains. “The synergy between the two sets of knowledge makes you better in both roles.”

Andrew completed his PhD under the supervision of Dr. Alan Wilman in the Department of Biomedical Engineering and was funded by a Vanier Scholarship (Canada’s most prestigious doctoral award). He developed a magnetic resonance imaging (MRI) method to evaluate iron levels in the deep grey matter of the brains of multiple sclerosis (MS) patients. He subsequently found a correlation between high iron levels in these brain areas and the disease’s severity, especially when evaluated longitudinally. Over the long-term, MRI assessment of iron could be used to evaluate MS disease progression and/or treatment effectiveness.

Andrew’s work was facilitated by his having access to the Peter S. Allen MR Research Centre, a 100 per cent research dedicated, state-of-the-art MRI facility at the U of A. Unique within Canada and recently expanded through a \$17.5M grant anchored by the Canada Foundation for Innovation, the facility has three MRI systems for full-body human imaging (field strengths: 1.5 T, 3 T and 4.7 T), all located inside the University Hospital.

Small things lead to big opportunities

Ryan Tucker (BSc 09) hopes to build a greener future for our planet by developing nanostructured electrodes for low cost, high efficiency energy conversion devices. He discovered a method to control the growth of transparent conductive single-crystal nanostructured materials with extremely high surface areas, making them ideal electrodes for next generation optoelectronic devices. This work was completed in the lab of Dr. Michael Brett (Micralyne/NSERC/iCORE Senior Industrial Research Chair, Canada Research Chair and Senior Research Officer with the National Institute for Nanotechnology) and has already resulted in a provisional patent application.

Ryan, a PhD candidate in the Department of Electrical and Computer Engineering with 14 journal publications and a long list of awards (including the Izaak Walton Killam Memorial Scholarship), is convinced that alternative energy technologies can solve the world's energy problems.

"It's completely possible as long as engineers can overcome the manufacturing challenges we face right now." For his part, Ryan intends to continue to contribute to these solutions by pursuing what he loves – inventive research and technology development.

With more than 150 professors and 1400 total interdisciplinary researchers (including 22 Canada Research Chairs, six NSERC industrial Research Chairs and a Canada Excellence Research Chair), the University of Alberta is a destination of choice for graduate students interested in nanotechnology research.



Admission

Admissions Requirements and Deadlines

If you currently hold a degree in Engineering or a related field and plan to apply to a graduate program, please contact the department offering the area of research in which you are interested. Individual departments have different application and entry dates, as well as different application procedures. Students are admitted for both September and January start dates.

For more information on the different graduate programs, visit each department's graduate studies site:

BIOMEDICAL ENGINEERING

www.biomed.engineering.ualberta.ca/Graduate

CHEMICAL AND MATERIALS ENGINEERING

www.cme.engineering.ualberta.ca/Graduate

CIVIL AND ENVIRONMENTAL ENGINEERING

www.civil.engineering.ualberta.ca/Graduate

ELECTRICAL AND COMPUTER ENGINEERING

www.ece.engineering.ualberta.ca/Graduate

MECHANICAL ENGINEERING

www.mece.engineering.ualberta.ca/Graduate

REMEMBER – graduate programs are highly individualized and academic qualification alone is not sufficient for admission in thesis-based programs. You must identify a specific project and have it agreed upon by a prospective thesis supervisor. For this reason, it is essential to approach individual professors working in areas of interest to you early in your search process.

Admission to all programs is administered through the Faculty of Graduate Studies and Research. Visit www.gradstudies.ualberta.ca for additional information about applications to graduate programs and other information about graduate studies at the University of Alberta.

Graduate students in the Faculty of Engineering have access to \$200M in state-of-the-art nanotechnology facilities on campus, including the nanoFAB, an open-access fabrication facility housed in Department of Electrical and Computer Engineering.

“These facilities give students access to all of the tools they need to follow their curiosity,” say Ryan Tucker (left). “If someone asks ‘Can we try that experiment here?’ the answer is ‘Yes! We can do that *today*.’”

International

International Applicants

The University of Alberta's Faculty of Engineering is home to more than 1200 international graduate students from more than 65 countries. International students and alumni praise the Faculty of Engineering for its highly respected and accessible faculty members and cutting-edge research facilities. They also appreciate Canada's safe, welcoming and supportive multicultural community.

International application deadlines

If you are applying from outside of Canada (or from within Canada with a study permit), you should be aware that most departments have earlier application deadlines for international applicants to accommodate timelines to secure any necessary visas.

English is the Faculty of Engineering's language of instruction. International applicants will require proof of their proficiency in English in order to be admitted. Proficiency is typically demonstrated using the Test of English as a Foreign Language (TOEFL).

International admission agreements

The University of Alberta has signed agreements to co-sponsor international student admission into several U of A graduate programs. The agreements promote collaboration in a variety of fields. Details can be found at: www.gradstudies.ualberta.ca/applyadmission/intl agreements

Financial Support for Graduate Studies

Almost all thesis-based graduate students receive financial support through external and internal scholarships, research assistantships, tuition support and teaching assistantships. Support levels vary, but are generally sufficient to cover tuition costs and basic living expenses. The Faculty of Engineering provides approximately \$19M in financial support to graduate students annually.

Additional information on funding for graduate students can be found on the University of Alberta's website: www.gradstudies.ualberta.ca/awardsfunding

Financial Support

Immediately after completing her PhD, Lucy Nolan (right) was hired as a yield engineer with Intel in Portland, Oregon. Because she sees new chip designs long before they come to market, the specifics of what she does are top-secret. Lucy now balances life in a lively city with the pursuit of a dream career.

"Working here is fantastic!" she says. "I'm working on projects that are on the absolute cutting edge. It's amazing."



Putting the polish on a bright future

After spending a semester at the University of Alberta in 2003 on exchange from the University of Wollongong in Australia, Lucy Nolan (BSc 04, PhD 12) realized she felt right at home in Edmonton. So, in 2008 she returned to the Faculty of Engineering to pursue her PhD as part of a research group led by Dr. Ken Cadien in the Department of Chemical and Materials Engineering. Dr. Cadien had recently left one of the most senior technical positions at Intel Corporation to become the Canada Research Chair in Nanofabrication.

Lucy's research focused on chemical-mechanical polishing of copper in the production of semiconductor devices. Copper has become the material of choice for the tiny 'wires' within microchips, but its use requires polishing with chemicals and nano-sized abrasives. Industry has been doing this successfully for years, but no one is entirely sure how it works, making the process difficult to improve.

"I discovered that, with literally thousands of variables, completely unpredictable outcomes, and no effective computer modeling system, the challenges in this field were enormous and incredibly exciting."

In addition to challenging herself intellectually at graduate school, Lucy found work-life balance by joining a local women's Australian Rules football team. After two years, she wound up playing for Canada in the 2011 International Cup in Australia (and winning a silver medal). It was a complete change from life in the lab.

"Graduate research is an individual pursuit," Lucy notes, "and to be part of a team was a great counterbalance. Practices and games were a real release."

Sinking his teeth into innovation

While Cristian Scurtescu (BSc 03, MSc 07) was still working on his graduate degree, he helped develop an innovative device to facilitate non-invasive treatment and prevention of dental root problems.

In 2008, he founded his own start-up company, SmileSonica Inc., with that early stage technology.

“There was no question in my mind that I’d matched a technical solution to a defined market need,” he says.

Today, SmileSonica employs more than 10 people – the majority of whom hold advanced degrees from the University of Alberta. Cristian plans to ship devices for use in dental practices within a year.

Cristian joined the Department of Electrical and Computer Engineering in 2004. He was one of three students to receive the iCORE International Student Award. During his MSc studies, Cristian participated in a collaboration between Engineering and Dentistry to design, test and fabricate microelectronic circuits and transducers for new intra-oral ultrasound devices intended to stimulate dental tissue repair.

After graduation, Cristian decided he needed to move the technology from the lab to dentists’ offices. His initial financial support and mentorship came from the MSTRI entrepreneur development program administered by the Faculty of Engineering (now called nanoBridge). With this funding and coaching, Cristian was able to build a solid business plan and work on early prototypes.





U of A

The University of Alberta

The University of Alberta is one of the top 100 universities in the world, and a leader amongst Canada's comprehensive, research-based universities. Founded in 1908, the University serves more than 38,000 students and has annual external research funding in excess of \$500M.

Faculty, staff and students in the 400 research laboratories on campus are focused on cutting-edge, multidisciplinary research and are supported by \$1.1B in new building construction and Canada's second largest library system. Technology translation at the University, an important focus for many members of the Faculty of Engineering and their collaborators, has resulted in 1150 invention disclosures, 360 patents, and 70+ spin-off companies in the last 13 years.

For more information about the University of Alberta, please visit: www.ualberta.ca



Cristian Scurtescu's startup company, SmileSonica, is currently focused on product development, thanks to a combination of private funds and provincial and federal grants. The company is housed in incubator space in the National Institute for Nanotechnology where Cristian and his team (left) can access prototyping tools in the nanoFAB, design software in the Integrated Nanosystems Research Facility, and product development resources from the Alberta Centre for Advanced MNT Products.

Edmonton

About Edmonton

Edmonton is the capital city of Alberta and home to more than one million people. Located along the North Saskatchewan river, the city is safe, welcoming and values multiculturalism. It boasts North America's largest expanse of urban parkland, which includes more than 97 km of multi-use trails.

Often called "Canada's Festival City," Edmonton hosts over 30 cultural festivals throughout the year to celebrate the arts, music, food and sport. Major annual events include Canadian Finals Rodeo, Edmonton Street Performers Festival, K-Days, Edmonton Folk Music Festival and the Fringe Theatre Festival.

The University of Alberta's main campus is located on the south side of the North Saskatchewan River. From campus, you can travel easily to other parts of the city via light rail transit and an extensive bus network. Downtown, which is approximately 10 minutes away by transit, is home to the head offices of many of Canada's largest engineering firms, including those who are close collaborators with the Faculty of Engineering. These firms help to drive Edmonton's diverse and robust economy, which ranges from knowledge-based to resource-driven industries, including oil production, petrochemicals, agriculture, forestry, mining and construction. Edmonton is also considered Canada's gateway to the robust resources sector in northern Alberta and northern Canada.

The campus is also a short walk from Old Strathcona, a historical district that is home to some of Edmonton's most unique shops, movie theatres, restaurants and coffee houses. For those wishing to venture farther afield, a few hours' drive west will bring you to Jasper National Park and Canada's Rocky Mountains, where you can explore the outdoors by camping, hiking, skiing, or simply enjoy the stunning scenery.



Edmonton is served by the country's fifth largest airport, Edmonton International Airport. Located approximately 20 minutes from the city's southern boundary, the airport offers non-stop air service to more than 50 national, U.S. and international destinations.

For more information about the city, please visit: www.edmonton.ca

Nadia Shafie Zadeh (right) chose the Department of Civil and Environmental Engineering at the University of Alberta for its outstanding international reputation and was pleased to accept a Provost Doctoral Entrance Award.

"At the University of Alberta, I've found a caring supervisor, excellent facilities and an interesting, industry-facing project," Nadia says. "All the tools for success in graduate school are here."



Looking beneath the surface for solutions

Nadia Shafie Zadeh (BSc 99, MSc 04) is trying to accurately characterize stresses in caprock materials for oils sands steam assisted gravity drainage (SAGD) and carbon capture and storage (CCS) projects. Caprock lies between a reservoir and the surface, and having an accurate understanding of the far-field stresses in this material improves reservoir safety and recovery. Combining data collected in-lab (for estimating geomechanical properties) with in situ micro-hydraulic fracturing data from industrial partners pursuing SAGD in Alberta's oil sands, Nadia is using numerical methods to provide new insights into caprock in situ stress interpretation.

Dr. Rick Chalaturnyk, Nadia's mentor, is the theme lead for CCS projects in the Helmholtz-Alberta Initiative (HAI). The HAI is a \$33M strategic alliance between the Helmholtz Association of German Research Centres and the University of Alberta that fosters international research collaborations in sustainable use of energy resources. As an HAI student, Nadia travelled to Germany to participate in the 2nd HAI Science Forum where she met her collaborators face-to-face. For Nadia, it was an important opportunity to observe alternate approaches to energy research.

Nadia's scientific curiosity has driven her to become an expert in her field. After completing both her BSc and MSc, and several years of work with Lar Consulting Engineers in Iran, Nadia chose to pursue further education in Canada.

"I was drawn to the combination of high technology research and a safe, friendly environment," she explains.

Graduating to a career

Christopher Lin (BSc 06, PhD 09) earned his PhD in a fast-paced research group, working directly with companies like NOVA Chemicals, General Electric and Imperial Oil. Mentored by Dr. Steven Kuznicki (Canada Research Chair and NSERC/NOVA Chemicals Senior Industrial Research Chair in Molecular Sieves) of the Department of Chemical and Materials Engineering, Christopher learned to critically analyze research questions and pursue inventive solutions. Along the way, he authored five patent applications and 18 peer-reviewed publications, all addressing the synthesis and applications of zeolite molecular sieves.

Christopher was hired as a Tailings Management Specialist at Imperial Oil immediately after graduation. His first assignment was to develop technologies to reduce oil sands tailings toxicity and accelerate reclamation. For Christopher, it represented a significant challenge in a new field.

“I immediately realized that I didn’t know the answer or even where to start,” he explains. “Fortunately, I had learned how to tackle a new discipline and new research questions in graduate school.”

With that experience and knowledge behind him, Christopher has been able to make significant and rapid progress in his work. In fact, the technology developed by his team has become a lead option for tailings management.

Christopher’s current focus is on the use and re-use of water in oil sands operations. He represents Imperial Oil’s water research programs in Canada’s Oil Sands Innovation Alliance, an industry-wide consortium. Christopher also acts as steward for projects within the Centre for Oil Sands Innovation (COSI) at the University of Alberta. The \$50M research centre is developing technologies for cleaner, lower-cost oil sands operations that reduce water and energy consumption, and greenhouse gas emissions. Through COSI, Christopher has the opportunity to work with Engineering faculty members who share his goal of “making Alberta’s energy a sustainable resource for the world.”



Integrated Circuits Interfacial Engineering Materials Processing Mathematical Modeling Metamaterials Micro- and Nano-Electromechanical Systems Micro- and Nanofluidics Mineral Processing Mining Engineering Molecular Sieves Nanoelectronics Nanofabrication Nanotechnology Non-Aqueous Bitumen Extraction Oil Sands Tailings Oil Sands Upgrading Petroleum Engineering Petroleum Thermodynamics Photonics and Electromagnetics Pipelines and Pipeline Transport Plasmas Polymer Engineering Power Electronics and Systems Process Control Rail Hazards and Safety Renewable Energy Robotics Safety and Risk Management Signal and Image Processing Smart Grids Software Engineering Solid Mechanics Structural Engineering Synthetic Biology Systems and Control Systems Biology Tailings Management Thermal Conversion Thermodynamics Thermo-fluids Transportation Engineering Unconventional Oil Recovery Water Quality Management Water Resources Welding and Joining Wireless Systems Advanced Fuel Cells Aerosols and Particle Dynamics Biochemical Engineering Biomechanics Biomedical Engineering Carbon Capture and Storage Catalysis and Reaction Engineering Colloids Communications Computational Intelligence Computer Engineering Construction Engineering and Management Corrosion and Wear Drug and Gene Delivery Electronic Materials and Devices Energy and the Environment Energy Systems Engineering Management Environmental Engineering Environmental Remediation Fluid Dynamics Geostatistics Geotechnical Engineering Information and Communications Technologies Integrated Circuits Interfacial Engineering Materials Processing Mathematical Modeling Metamaterials Micro- and Nano-Electromechanical Systems Micro- and Nanofluidics Mineral Processing Mining Engineering Molecular Sieves Nanoelectronics Nanofabrication Nanotechnology Non-Aqueous Bitumen Extraction Oil Sands Tailings Oil Sands Upgrading Petroleum Engineering Petroleum Thermodynamics Photonics and Electromagnetics Pipelines and Pipeline Transport Plasmas Polymer Engineering Power Electronics and Systems Process Control Rail Hazards and Safety Renewable Energy Robotics Safety and Risk Management Signal and Image Processing Smart Grids Software Engineering Solid Mechanics Structural Engineering Synthetic Biology Systems and Control Systems Biology Tailings Management Thermal Conversion Thermodynamics Thermo-fluids Transportation Engineering and the Environment Unconventional Oil Recovery Water Quality Management Water Resources Welding and Joining



FACULTY OF
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University of Alberta

facebook.com/UofAEngineering

ABOUT THE DEPARTMENT

The bridge between Medicine and Engineering – In Biomedical Engineering, researchers actively apply engineering advances directly to patients in collaboration with medical practitioners.

Home to a dedicated, state-of-the-art Magnetic Resonance Imaging (MRI) facility – Unique within Canada, the Peter S. Allen MR Research Centre has three MRI systems for human imaging (field strengths: 1.5 T, 3 T and 4.7 T), all located inside the University Hospital. The facility was recently expanded through a \$17.5M grant anchored by the Canada Foundation for Innovation.

Professors directly affect patient care and industry practice – The work being done in the Department is making a difference in people's lives through engineering advances in nanostructured biomaterials and MRI for neurological, psychiatric and cardiovascular diseases.

Focused on mentorship – Eight core professors and 40 adjunct professors from across campus are available to supervise graduate students.

RESEARCH STRENGTHS

Nanostructured Biomaterials

Spinal Cord Injury and Rehabilitation

Magnetic Resonance Imaging (MRI)

Magnetic Resonance Spectroscopy

PROGRAMS

MSc Master of Science

PhD Doctor of Philosophy

MD-PhD Program
(Joint with the Faculty of
Medicine and Dentistry)

FUNDING

Each graduate student receives financial support through research assistantships provided by the supervisor's research grants. Graduate students are also encouraged to apply for external scholarships and awards.

CONTACT US

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DEPARTMENTAL APPLICATION DEADLINES

Canadian and U.S. Applicants:

None

Allow one month for application processing

Applicants from Nigeria, Iran and the People's Republic of China:

May 1 for September (Fall) Admission

September 1 for January (Winter) Admission

Other International applicants:

July 1 for September (Fall) Admission

November 1 for January (Winter) Admission

Department of
Biomedical
ENGINEERING



www.biomed.engineering.ualberta.ca/Graduate

ABOUT THE DEPARTMENT

The largest Civil Engineering graduate program in Canada – Our program is strengthened by more than 500 graduate students from over 40 countries.

Industrial partnerships that support student learning

– We have built strong relationships with local, national and international organizations, including PCL Construction, Syncrude, Suncor, Shell, CN, CP, CNRL, Teck and BP.

Program breadth – We offer graduate studies in ten areas of specialization: Civil Engineering, Construction Engineering and Management, Environmental, Geoenvironmental, Geotechnical, Petroleum, Mining, Structures, Transportation and Water Resources Engineering.

Home to internationally recognized research leaders

– Our faculty includes seven NSERC Industrial Research Chairs, the Canada Research Chair in Natural Resources Uncertainty Management, and Endowed Chairs in nanofibre research, steel structures, and masonry systems.

Home to the new Canadian Rail Research Laboratory

(CaRRL) – CaRRL works to address key challenges in the Canadian rail sector, including: safety and security, long travel distances, sparse population, and extreme climates.

RESEARCH STRENGTHS

Advanced and Smart Materials

Construction Engineering Simulation

Cold Region and River Ice Engineering

Emerging Technology in Nanocellulose Fibres

Enhanced Oil/Heavy-Oil Recovery

Geostatistics in Mining Engineering

Human Biomechanics

Oil Sands and Oil Reservoir Simulation Research

Oil Sands Tailings Management

Petroleum Geomechanics

Road Infrastructure and Underground Trenchless Technology

Safety and Intelligent Transportation Systems

Slope Stability and the Cyclic Loading Of Embankments

Structural Health Monitoring and Modeling

Water and Wastewater Treatment

PROGRAMS

MSc Master of Science

PhD Doctor of Philosophy

MEng Master of Engineering*

MBA/MEng (Joint with
Alberta School of Business)*

*Course-based programs

FUNDING

Financial assistance is available for students enrolled in thesis-based degrees. Students are encouraged to apply for scholarships, which will reduce workload resulting from teaching or supplemental research duties. Assistantships are available to both Canadian and international students.

CONTACT US

Civil and

Environmental Engineering

3-133 Markin/ CNRL Natural
Resources Engineering Facility
9105-116 Street
Edmonton, Alberta
Canada T6G 2W2

Phone: 780.492.4235
cgradvis@ualberta.ca

DEPARTMENTAL APPLICATION DEADLINES

Canadian/Permanent Resident applicants:

July 1 for September (Fall) Admission

October 30 for January (Winter) Admission

International applicants:

(including applicants within Canada
applying for a study permit):

April 30 for September (Fall) Admission

July 31 for January (Winter) Admission

Department of

Civil & Environmental Engineering

School of

Mining & Petroleum Engineering



FACULTY OF
ENGINEERING
UNIVERSITY OF ALBERTA

www.civil.engineering.ualberta.ca/Graduate

ABOUT THE DEPARTMENT

Home to three major research centres – The Canadian Centre for Clean Coal/Carbon and Mineral Processing Technologies (C⁵MPT), the Canadian Centre for Welding and Joining (CCWJ) and the Centre for Oil Sands Innovation (COSI).

Research excellence – Over 50 faculty members hold more than 25 prestigious provincial, national and international research awards and chair positions, including seven NSERC Industrial Research Chairs, seven Canada Research Chairs, and a Canada Excellence Research Chair.

Partnerships with local companies – Research partnerships mean graduate students can spend extended periods at industrial sites. Industrial participation in graduate training allows graduates to transition seamlessly into industry or entrepreneurial endeavours.

Collaboration with the National Institute for Nanotechnology (NINT) – Researchers work closely with the National Institute for Nanotechnology (NINT), a joint venture with the National Research Council Canada (NRC) that hosts world-leading nanotechnology facilities and research programs.

Focus on teaching and learning – Faculty members prioritize mentoring and teaching: CME faculty members hold numerous teaching awards including the Engineers Canada Medal for Distinction in Engineering Education and the APEGA Excellence in Education Award.

Home to the Engineering Safety and Risk Management Program – The first of its kind in Canada.

RESEARCH STRENGTHS

Biochemical Engineering

Biomedical and Regenerative Medicine

Corrosion and Wear

Fluid Dynamics

Materials Characterization and Processing

Mathematical and Molecular Modeling

Nanomaterials and Nanofabrication

Oil Sands Energy

Process Control and Systems Engineering

Reactions and Catalysts

Surface Science and Engineering

Thermodynamics

Welding and Metallurgy

PROGRAMS

MSc Master of Science

MEng Master of Engineering*

PhD Doctor of Philosophy

*Course-based program

FUNDING

The department provides financial support for PhD and MSc students through teaching assistantships, research assistantships and scholarships. Graduate students are also encouraged to apply for external funding through scholarships and awards.

DEPARTMENTAL APPLICATION DEADLINES

Canadian/Permanent Resident applicants:

August 15 for September (Fall) Admission

December 1 for January (Winter) Admission

International applicants:

April 1 for September (Fall) Admission

October 1 for January (Winter) Admission

CONTACT US

Chemical and Materials Engineering

7th Floor, Electrical and Computer
Engineering Research Facility (ECERF)
9107-116 Street
University of Alberta
Edmonton, Alberta, Canada
T6G 2V4

Phone: 780.492.3321

chemmat@ualberta.ca

Department of

Chemical & Materials ENGINEERING



www.cme.engineering.ualberta.ca/Graduate

ABOUT THE DEPARTMENT

State-of-the-art facilities – We have top-notch facilities in all areas of Electrical and Computer Engineering, including the nanoFAB, a 600 m² nano- and micro-fabrication facility with capabilities unique in Canada.

Active national and international collaboration – The Department maintains active international collaborations, including close ties to the National Institute for Nanotechnology (NINT) located on the University of Alberta campus. These collaborative relationships give students access to many top national and international research facilities.

Strong research output – Our faculty members and their students have published the largest number of peer-reviewed publications of any Electrical and Computer Engineering department in Canada (2006 to 2012). Many of those publications are in prestigious journals such as *IEEE Transactions*, *Physical Review Letters*, *Nature* and *Science*.

Partnerships with industry – Our relationships with industry partners give graduate students the opportunity to work in real-world scenarios and build their professional networks. Motivated students have been supported in starting successful spin-off companies.

Outstanding graduate students – Many of our graduate students have earned prestigious academic, research and leadership awards, such as Vanier Canada Graduate Scholarships, Izaak Walton Killam Memorial Scholarships and Andrew Stewart Memorial Graduate Prizes.

RESEARCH STRENGTHS

Biomedical Engineering

Communications

Computer Engineering

Control Systems

Electromagnetics and
Microwaves

Energy Systems

Integrated Circuits and
Systems

Microsystems and
Nanodevices

Photonics and Plasmas

Signal and Image
Processing

Software Engineering
and Intelligent Systems

Solid State Electronics

PROGRAMS

MSc Master of Science

PhD Doctor of Philosophy

MEng Master of Engineering*

MINT Master of Science in
Internetworking*
(Joint with the Department of
Computing Science)

MBA/MEng (Joint with Alberta
School of Business)*

*Course-based programs

FUNDING

The Department provides financial support to graduate students through research and teaching assistantships, including some tuition scholarships. All applicants are automatically considered for these awards during the review of their application. Graduate students are also encouraged to apply for external scholarships and awards.

DEPARTMENTAL APPLICATION DEADLINES

Canadian applicants:

July 1 for September (Fall) Admission

November 1 for January (Winter) Admission

(However, applications will be accepted until positions are filled.)

International applicants:

April 30 for September (Fall) Admission

July 30 for January (Winter) Admission

CONTACT US

Electrical & Computer Engineering

2nd Floor, Electrical and Computer
Engineering Research Facility (ECERF)
9107-116 Street
University of Alberta
Edmonton, Alberta
Canada T6G 2V4

Phone: 780.492.3332
ecegadm@ualberta.ca

Department of

Electrical & Computer ENGINEERING



www.ece.engineering.ualberta.ca/Graduate

ABOUT THE DEPARTMENT

A top Canadian School for Mechanical Engineering education – The Department of Mechanical Engineering is among the most productive, recognized, well-funded and reputable Mechanical Engineering Departments in Canada.

An internationally recognized faculty – Department faculty include two endowed research chairs, a Canada Research Chair, three NSERC Industrial Research Chairs, two CSME Fellows, an ASME Fellow, two Engineering Institute of Canada Fellows, and an American Association for Aerosol Research Fellow.

A focus on graduate student mentorship and education – Our goal is to prepare students to meet the demands of academia and industry in a well-supported, collegial and interdisciplinary environment.

At the forefront of innovation, research and scholarship – Our academics have established industrial and international collaborations that focus on real-world issues and improve graduate student training in areas crucial to the Canadian and world economies.

World-class facilities and equipment – Our state-of-the-art testing, computational and production infrastructures serve our research community and beyond.

Located at the gateway to the north – Edmonton is the gateway to the tremendous opportunities in oil and gas, and home to one of the fastest growing, most vibrant economies in the world.

RESEARCH STRENGTHS

Biomechanics and
Biomedical Engineering

Energy and Environment

Engineering
Management

Nano and Micro
Technologies

Thermo-Fluids

Solid Mechanics

PROGRAMS

MSc Master of Science

MSc Master of Science in
Engineering Management

PhD Doctor of Philosophy

PhD Doctor of Philosophy in
Engineering Management

MEng Master of Engineering*

MBA/MEng (Joint with Alberta
School of Business)*

*Course-based programs

FUNDING

Applicants seeking financial support must arrange funding with their supervisor before being granted acceptance. Financial support is provided through research and teaching assistantships. Graduate students are also encouraged to apply for external scholarships and awards.

DEPARTMENTAL APPLICATION DEADLINES

Canadian applicants:

June 30 for September (Fall) Admission

October 30 for January (Winter) Admission

Applicants from Nigeria, Iran and the People's Republic of China:

March 15 for September (Fall) Admission

July 15 for January (Winter) Admission

Other International applicants:

May 15 for September (Fall) Admission

September 15 for January (Winter) Admission

CONTACT US

Mechanical Engineering

4-9 Mechanical Engineering Building
University of Alberta
Edmonton, Alberta
Canada T6G 2G8

Phone: 780.492.1640
mece.grad@ualberta.ca

Department of

Mechanical ENGINEERING



www.mece.engineering.ualberta.ca/Graduate