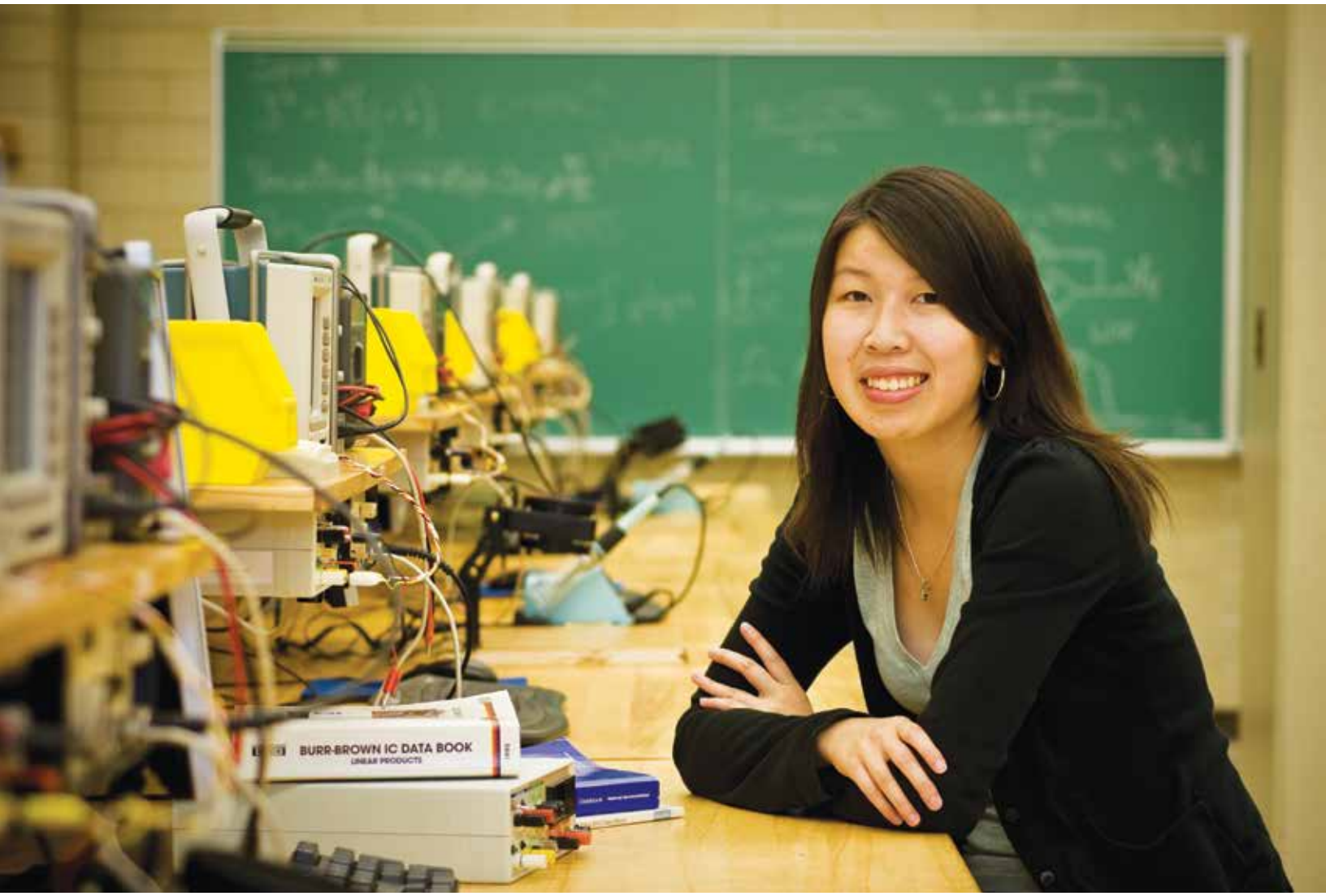
OTTAWA, CANADA

Carleton University

FACULTY OF ENGINEERING AND DESIGN



Carleton UNIVERSITY

Canada's Capital University

carleton.ca

The Carleton Advantage

Welcome to Carleton University, where our beautiful campus overlooks the Rideau River and the Rideau Canal in Ottawa, Canada's national capital. Here, your program, your university experience and your future success are our priorities.

Carleton provides a stimulating and supportive community for your studies in engineering and design. Choose from a comprehensive range of rigorous, innovative programs that challenge you to do your best—you have the flexibility to select the degree most appropriate for your interests, aptitudes and career goals. Many of our programs offer additional opportunities for specialization through concentrations and streams, and can be enhanced with co-operative education and fieldwork to give you practical experience.

You will be taught by experienced professors who are renowned experts in their fields and engaged in research on the national and international stage. You will have access to world-class facilities—state-of-the-art wind tunnels and strong floors, microchip fabrication facilities and the latest in laboratories, design studios and advanced computer and networking platforms. You will work on invigorating team projects, be inspired by guest speakers, and apply your creativity and innovation in new ways while preparing for a career in engineering or design.

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Message from the Dean

Carleton University's Faculty of Engineering and Design has an international, long-standing reputation for excellence in education and research. Our engaging programs in engineering, architecture, industrial design and information technology give you the best possible education and prepare you for a successful and satisfying career.

You will be taught by faculty members who bring research expertise and industry know-how to the classroom. Award-winning teachers, Canada Research Chair holders and extraordinary professors share their passion for engineering and design disciplines with you.

Campus clubs and societies help you explore new interests, take on leadership roles and meet new friends who share your creativity and curiosity. Co-op work helps you apply your knowledge and build your resumé, and the supportive campus community helps you succeed every step of the way.

As a graduate of Carleton, I am proud to represent the Faculty of Engineering and Design. We offer one of the most comprehensive platforms of engineering education in Canada at the undergraduate and graduate levels. Our program offerings continue to grow and adapt to the changing needs of society so that our graduates have the knowledge and skills to shape the future.

With the latest equipment from corporate partners and continued investment in state-of-the-art, industry-sponsored laboratories and facilities, Carleton offers you a hands-on education with real-world application.

The engineering and design professions are engines of economic growth. Through the introduction of new products and technological innovations, engineers and designers continue to improve our standard of living.

I invite you to join us at Carleton University and realize your full potential in engineering and design.

Dr. Rafik A. Goubran, PEng, FIEEE, FCAE
Dean, Faculty of Engineering and Design

Simon Mack landed a co-op placement with the National Research Council's Flight Research Laboratory in his third year of electrical engineering.

Gain Real-World Experience

Learning by doing is a rewarding enhancement to your academic studies in classrooms and laboratories. Combine your academic studies with periods of paid employment in your field through co-operative work terms. You gain valuable experience in your field of study, develop professional contacts, and earn money to help pay for your studies.

Learning through co-op

Co-operative education lets you gain practical experience, solve real-world problems, and apply classroom theory and knowledge to practical work situations.

All our engineering and design programs have a co-op option with work term placements of 4, 8, 12 or 16 months, with one or multiple employers. A co-op work term typically begins at the end of second year, when you have the ability, knowledge and confidence to make a substantial contribution to the organization. As you gain more knowledge and skills, your work terms become longer—allowing you to complete projects and get involved in more ambitious, complex activities. Although getting your degree can take a little longer, the investment is worth it: four work terms give you a co-op designation on your degree and will kick-start your career.

carleton.ca/cc

Recent employers

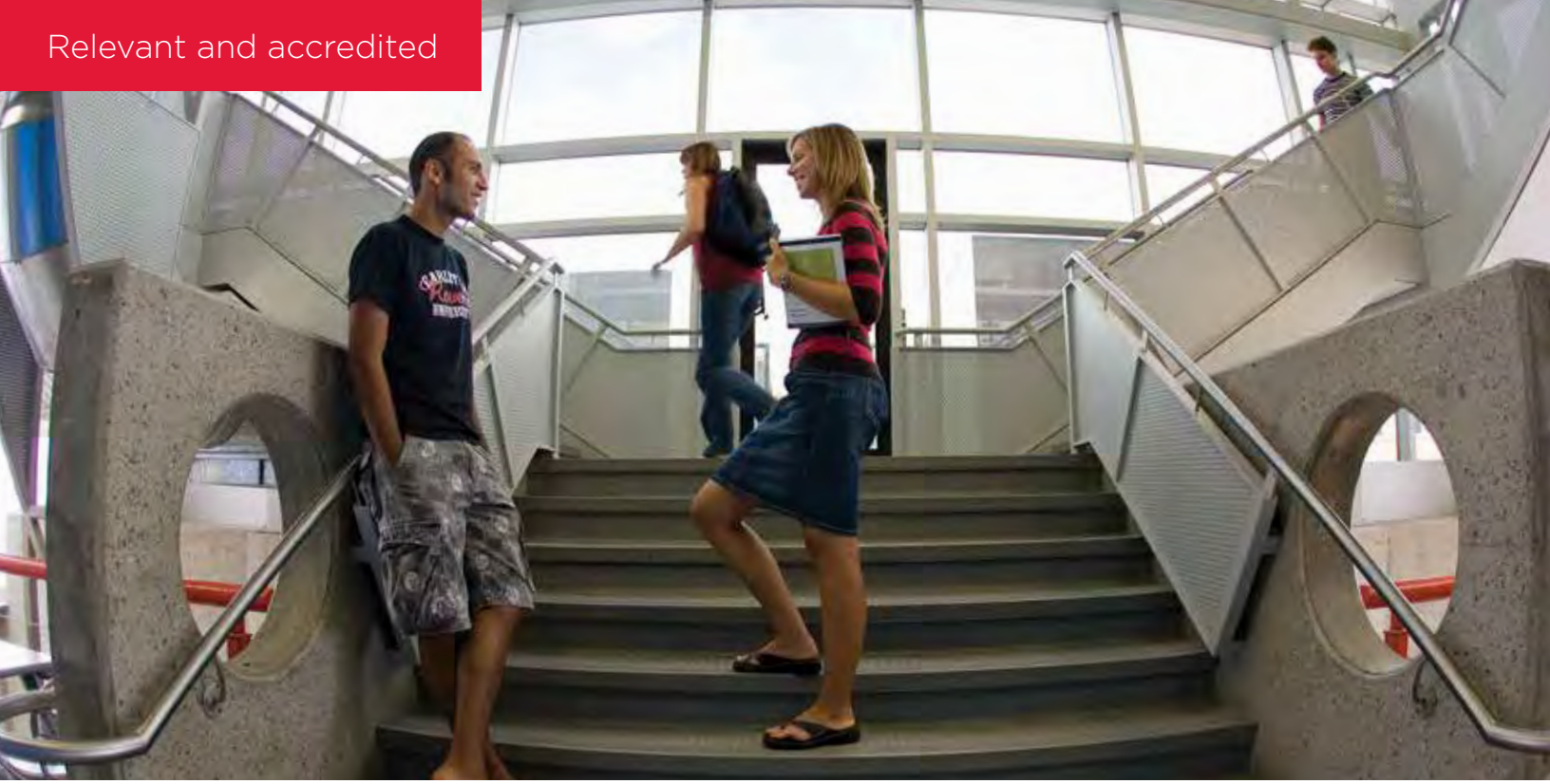
The National Capital region is home to one of Canada's largest concentrations of government research agencies and high-tech companies. Carleton's co-operative education program is well established in this network, providing you with superb opportunities for rewarding experiences in well-known organizations such as:

- Alcatel-Lucent
- City of Ottawa
- Department of National Defence
- Ericsson
- Flextronics
- GasTops
- General Dynamics Canada
- IBM
- National Research Council Canada
- Ottawa Aviation Services
- BlackBerry
- Teknion Furniture Systems

You can also work nationally—with organizations such as the Canadian Space Agency, Kelowna Flightcraft, Rolls Royce Canada and Electronic Arts Canada—or right here at Carleton, working in a research lab for the summer, supported by federal research grants from agencies such as the Natural Sciences and Engineering Research Council.

Career development

Co-op and Career Services provides free career planning and advice, and helps connect you with potential employers through networking events, job postings and career fairs. In the first year of your studies, you can access services and programs that will help you make a successful transition from school to work.



Engineering, Design and You

THE CAPITAL ADVANTAGE
Ottawa is a global technology leader. Sharing a city with some of the world's best tech companies and government laboratories offers great opportunities for co-op and internship placements—and future employment. Nearly 79,000 people work in more than 1,800 tech companies, including multinational giants leading the way in telecommunications, security and defence, software, aerospace, the environment, construction, semiconductors, wireless, software and life sciences.

carleton.ca/engineering-design

Our global society needs people with degrees and professional qualifications in engineering and design disciplines. Carleton is recognized as having a leading engineering and design faculty in Canada, with the most extensive range of programs in the country. You can graduate with the knowledge to design buildings, aircraft, software, telecommunications systems, medical devices or environmental solutions to pollution.

The Bachelor of Engineering, Bachelor of Architectural Studies, Bachelor of Industrial Design and Bachelor of Information Technology degrees are highly desirable in today's fast-paced, technology-driven world. Our programs will expose you to exciting technological advances in information storage, global communications networks, computer-aided design and 3D-image manipulation technologies.

From aircraft simulators, to advanced water and waste water treatment methods, to offshore structures, to new transportation approaches, to transistors that are smaller than most living cells...you'll be amazed how you can shape the future.

Learning by doing

Teaching is a major focus at Carleton. We have one of the best professor-to-student ratios in Canada and our professors are known and respected nationally and internationally. You benefit directly from the expertise and experience of many senior professors teaching first-year courses.

In the Faculty of Engineering and Design, we not only teach, we create new knowledge. Carleton's links with some of the best-known Canadian companies and government departments and agencies mean that our programs are on the cutting-edge of advances.

A Carleton education will teach you to use both your mind and your hands. We emphasize problem solving through laboratory work. You then get the chance to apply your theoretical knowledge in the real world in co-op work terms and fourth-year projects.

If you enjoy competition and teamwork, you can test your knowledge and match wits with other university students by entering engineering and design competitions at the departmental, provincial or national levels. You will hone your professional presentation skills and be exposed to mentors and business contacts important to your future.

Areas of study

Carleton is one of the nation's leading institutions in the study and research of engineering, architecture, industrial design and information technology. Our comprehensive programs provide an outstanding education in an environment that is challenging, diverse and flexible. We offer four broad areas in which you can study, and all programs have the option of a minor in business.

ARCHITECTURAL STUDIES
carleton.ca/architecture

As a student in the Azrieli School of Architecture and Urbanism, you can choose to concentrate your studies on architectural design, urbanism, or conservation and sustainability. You begin your studies with courses in drawing, multimedia applications, art history and the social sciences. As you progress, you pursue your own research in workshops, gain exciting hands-on experience, visit local building sites, and have the option to study abroad in your third year. When you graduate from the architecture program at the master's level you will meet the educational requirements for your professional registration from the Canadian Architectural Certification Board.

ENGINEERING
carleton.ca/engineering-design

Carleton's engineering program ranks among the best in the country. Students begin with a common foundation in mathematics, physical sciences and engineering principles. You have the choice of specialized programs: aerospace; architectural conservation and sustainability; biomedical and electrical; biomedical and mechanical; civil; communications; computer systems; electrical; engineering physics; environmental; mechanical; software; or sustainable and renewable energy.

Each discipline provides opportunities for you to specialize according to your interests and career goals.

INDUSTRIAL DESIGN
id.carleton.ca

Industrial design bridges the gap between technological developments and human users of these innovations. In this program, you will learn the many elements that contribute to making technology serve people better. Starting with a firm base in mathematics, economics, psychology and physical sciences, Carleton's School of Industrial Design will introduce you to the modern production and innovation that goes into the development of all new products. You will study the aspects of design that make products successful—both technically and commercially—and have the opportunity to highlight your work in an annual exhibition that has become a showcase for the university's most promising graduates.

INFORMATION TECHNOLOGY
bitdegree.ca

A partnership between Carleton and Algonquin College, the School of Information Technology offers innovative programs with a strong mix of theoretical concepts and hands-on training that stay current with the fast pace of change in the high-tech industry. You'll earn both a Bachelor of Information Technology (BIT) degree and an Advanced Diploma of Applied Art in the Interactive Multimedia and Design program, or a BIT and Advanced Diploma in Technology for Network Technology or Photonics and Laser Technology. BIT programs offer co-op options with high placement rates.

Your Carleton degree is:

- relevant
- in demand
- well recognized
- innovative
- hands-on

From optimizing a helicopter rotor for quieter and more efficient operation to designing and manufacturing propellers for unmanned aircraft, Carleton students and researchers are changing how we fly.

Aerospace Engineering

In the 20th century, humans realized the age-old dream of flying. Today, the modern aerospace industry in Canada is vigorous, innovative and highly competitive.

Carleton University established the first Bachelor of Engineering degree program in aerospace engineering in Canada. Generating more than $22 billion in annual revenue and employing more than 80,000 people, the Canadian aerospace industry has a worldwide reputation for leadership in fields including commuter and business aircraft, gas turbine power plants, aircraft simulators, communications satellites and guidance systems.

Your opportunities

- Specialize in aerodynamics, propulsion and vehicle performance; aerospace structures, systems and vehicle design; aerospace electronics and systems; or space systems design.
- Gain real experience through co-op work placements, a final-year design project that emulates a design office setting at an aerospace firm, and a program that emphasizes problem-solving skills and hands-on laboratory and design work.
- Access unparalleled laboratory and computer facilities, including atmospheric boundary-layer and supersonic wind tunnels; a large-scale water channel; model satellites; thermal and vibration testing of satellite sub-structures; structural testing of aircraft components; material processing equipment; equipment for the study of heat transfer phenomena; and training on avionics systems.

www.mae.carleton.ca

New heights

With an Ottawa-based geophysics company, Carleton students are developing an integrated multi-mission unmanned aircraft system (UAS) as a fourth-year design and graduate research project. The UAS, called GeoSurv II, will conduct high-resolution magnetic surveys. The objective of this research and development program is to design, manufacture, and flight test innovative solutions for autonomous operation, obstacle detection, low-cost composite airframes, magnetic signature control, and geomagnetic data acquisition.

You might also be interested in mechanical or computer systems engineering.

Visit carleton.ca/cuuc for information on course and co-op education options.

- Develop contacts for future employment through Carleton's close association with government research organizations such as the National Research Council Canada and the Canadian Space Agency.

Your program

The program begins with a common set of courses in engineering and science to provide a foundation in the key disciplines of dynamics, thermofluids, solid mechanics and materials essential to the design of airframes, space platforms, propulsion systems and control systems. These are followed by specialized courses according to your stream:

- **aerodynamics, propulsion and vehicle performance** specializes in aircraft aerodynamics, performance, control and propulsion technologies;
- **aerospace structures, systems, and vehicle design** focuses on lightweight structures and materials for aircraft and spacecraft;
- **aerospace electronics and systems** concentrates on modern aircraft and spacecraft electronics for navigation, guidance, communication and remote sensing; and
- **space systems design** emphasizes spacecraft design and mission planning, with courses dedicated to orbital mechanics, spacecraft design, communication, propulsion and dynamics.

Your future

You will be prepared for a challenging career in the aerospace design and manufacturing industry, airline and space operations, government research laboratories, and aircraft certification and accident investigation authorities.

- Progressive co-op education option
- Scholarships for high-standing students
- Accredited by the Canadian Engineering Accreditation Board

You can get involved with many student clubs on campus, including the team that competes in the annual NASA Great Moonbuggy Race. Inspired by the lunar rovers used by Apollo astronauts to travel over tough terrain on the moon, the competition challenges students to design a human-powered vehicle to carry two students over a half-mile course that includes craters, rocks, lava ridges, inclines and lunar soil. The Carleton team designs the components for its vehicle, manufactures and assembles the parts, and tests and modifies the design before the competition.

Carleton's newest engineering building not only provides classroom and laboratory space, but also real-time and historical data that students can use to solve building design problems. The sophisticated building is equipped with sensors and actuators from Delta Controls that monitor building energy use and respond to occupant needs for light, temperature and air quality. This allows researchers to study how people use buildings, to experiment with how to reduce energy use, and to explore and develop new sensor and building automation technology.

Architectural Conservation and Sustainability Engineering

Whether in designing new "green" buildings or retrofitting heritage properties, modern societies are demanding economic, social and environmental sustainability. By combining civil and environmental engineering and architectural studies, Carleton's program—the first of its kind in Canada—is educating experts in sustainable green building design and heritage conservation.

Architectural conservation and sustainability engineers apply their knowledge in sustainability to the design and retrofit of new and existing buildings and structures, considering life-cycle costs, impacts of selected materials, and energy needs and consumption. They also bring their expertise to the burgeoning field of conservation, repairing and adapting structures with various levels of heritage designation.

Your opportunities

- Specialize in structural or environmental streams of study.
- Benefit from the multi-disciplinary program that draws on the resources of and collaboration with a top-notch engineering faculty and renowned architecture program.
- Gain real experience by collaborating on projects with architecture students and through a challenging and hands-on final-year project that brings together your knowledge, skills and expertise.

carleton.ca/cee

Graduates of the program will have the knowledge and skills to use resources efficiently while creating buildings that are better for both human health and the environment.

Visit **carleton.ca/cuuc** for information on course and co-op education options.

You might also be interested in the structural stream of civil engineering.

- Progressive co-op education option
- Scholarships for high-standing students
- Option of a structural or environmental stream
- Designed to meet the Canadian Engineering Accreditation Board standards for the educational requirements for registration as a professional engineer

- Access computer rooms and engineering laboratories with state-of-the-art equipment including laser scanners to develop 3D images of heritage sites and a fully instrumented building to evaluate energy use.
- Develop contacts for future employment through Carleton's close association with advanced research institutions, such as the National Research Council Canada, Natural Resources Canada and Environment Canada, and key industry and government partners, such as the Heritage Conservation Directorate, Public Works and Government Services Canada, the Canada Green Building Council, and Canada Mortgage and Housing Corporation.

Your program

In the first two years, students in the **structural stream** and the **environmental stream** study a similar core of courses in engineering, math, science and introductory architecture. In the third and fourth years, students in both streams study green building design and rehabilitation of heritage buildings and complete a specialized design project.

As a structural stream student, you will concentrate on conservation and sustainability in the design of new structures, and the assessment, rehabilitation and retrofit of existing structures.

The environmental stream teaches sustainable building practices with a focus on life-cycle analysis of structures, water quality and conservation, air quality, green materials and effective waste management.

Your future

You will have a skill set that industry has identified as lacking in current post-secondary education in Canada. You will be well equipped with the knowledge and skills needed to work in the engineering field and will benefit from the increased recognition of the need for building professionals with specific expertise in historic or designated heritage buildings and the conservation process.

You will be prepared to continue studies in graduate programs in conservation and sustainability or a professional designation as an architect through Carleton's Master of Architecture program.

Map the Kasbah

Professor Mario Santana Quintero and his students travelled to Ouarzazate, Morocco, to perform an architectural survey of the Kasbah of Taourirt. The site is a 1.6 hectare, four-level complex constructed of rammed earth and adobe with beautifully decorated surfaces. Considered part of the national heritage, the kasbah is one of the most-visited sites in the region. The architectural drawings prepared by the Carleton team will be used as part of a larger project to develop and apply a methodology for the documentation, emergency stabilization, and integrated conservation planning for the rehabilitation of earthen architecture settlements by the Getty Conservation Institute and the Centre de conservation et réhabilitation du patrimoine architectural des zones atlasiques et sub-atlasiques.

Biomedical students are developing new algorithms to assess asthma and obstructed breathing and comparing them to existing methods. Here, a spirometer measures the volume of air breathed in and out, while the sealed plethysmograph chamber detects changes in pressure to monitor lung volume and effort.

Biomedical and Electrical Engineering

Increasingly, the field of health care relies on technology. Biological signals, such as those from the heart and brain, are routinely used for both diagnostic and therapeutic purposes. Computer tools are used to collect and analyze data, such as gene sequence databases that contain millions of entries.

Sensors, actuators and electronics make medical devices work—and can even be used to deliver drugs inside the human body. Advances in medical imaging techniques such as MRI and PET scans lead to the early diagnosis, and better treatment and prevention, of disease. Medical informatics, telemedicine and electronic health records help improve the delivery of health care.

Biomedical and electrical engineering is a fast-growing field that uses technology to design and build new components and systems for biomedical solutions to problems in medicine and biology.

Your opportunities

- Focus on bioinformatics, bio-signal processing, information technology

in biomedicine, micro-technology for sensors and micro-electro-mechanical systems (MEMS), instruments and measurements, and cardiovascular devices.

- Access state-of-the-art biomedical research facilities, including a biological signals laboratory and medical imaging laboratory, telemedicine and tele-operations facilities, a superb undergraduate computing network, portable biological signal acquisition equipment, and prototyping workstations; and laboratories sponsored by companies such as Alcatel, Texas Instruments and Mitel.
- Develop contacts for future employment through Carleton's close association and collaboration with prominent professors from the medical field and local hospitals, such as the Children's Hospital of Eastern Ontario and the University of Ottawa Heart Institute, among other health care establishments.

Your program

Learn the fundamentals of science and mathematics, including biology, chemistry and physics in first year. Second year introduces courses in electronic circuit design, numerical analysis and programming. In third year, specialize in digital and analog circuit design, semiconductor device physics, electromagnetics and bioelectrical and biomedical systems. Senior courses involve advanced study in biomedical engineering, including signal processing and medical instrumentation, with opportunities to apply your knowledge to the biomedical and health care fields. You will gain hands-on practice through supervised project work, extensive laboratory and clinical field experience, and oral and written presentations.

Professor Adrian Chan and his students examine whether food-borne bacteria can be detected and identified by odour. Here, they prepare samples to be tested by an electronic nose.

Your future

You can find employment in health-care establishments and medical facilities, working with computers, medical equipment or medical devices or developing health care technologies such as electronic implants, safer medical materials and devices, or superior data management and diagnostic systems. You will be well prepared for continued studies at the graduate level or in medicine.

You might also be interested in electrical engineering or computer systems engineering.

Visit carleton.ca/cuuc for information on course and co-op education options.

- Progressive co-op education option
- Scholarships for high-standing students
- Accredited by the Canadian Engineering Accreditation Board
- Designed to meet prerequisite courses for most medical schools in North America

Making navigation easier

Interdisciplinary teams of students, supervised by Professor James Green, worked with a 12-year-old visually impaired swimmer and her coach to develop a swimming cap that vibrates to provide feedback on her position in the pool lane—a critical function to prevent a high-speed collision with the concrete wall.

Now Dr. Green has added a robotic "guide dog" for visually impaired users to the fourth-year projects choices. The multi-year project will challenge each student team to develop and refine a system that can navigate a sidewalk—alerting users to curbs, reading pedestrian traffic symbols and street signs and communicating these to the user, reporting location and direction, and responding to voice commands.

Idana Veledar examines fixation and movement of a total hip replacement in an artificial thigh bone after subjecting it to the types of loads that would be expected in daily activities such as walking and stair climbing.

Biomedical and Mechanical Engineering

Biomedical engineers apply engineering principles to aspects of medicine to improve healthcare diagnosis, monitoring and therapy. They help create prostheses, artificial organs, drug delivery systems and a range of surgical and life-support systems. By combining a foundation of mechanical engineering with the rapidly growing discipline of biomedical engineering, biomedical and mechanical engineers analyze and solve problems related to biomechanical engineering, biotechnology and medicine.

Your opportunities

- Access well-equipped laboratories and computer facilities for experiments and design projects that emphasize problem-solving skills and hands-on experience with artificial devices for bone repair or replacement, mock cardiovascular systems, biomaterial testing, and gait measurement.
- Develop contacts for future employment through Carleton's close association and collaboration with medical researchers and local hospitals, biotechnology firms,

Carleton graduate student Andrew Geddes developed a device to measure the position and force of a doctor's fingertips during abdominal examinations.

You might also be interested in biomedical and electrical engineering.

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research institutions and government agencies and departments.

- Benefit from an inter-disciplinary academic approach and opportunities to work with, and learn from, students in other engineering programs.

Your program

In your first year, you will learn the fundamentals of basic science and mathematics, with courses in biology, chemistry and physics. Second year offers introductory courses in fluid mechanics, solid mechanics, thermodynamics, materials and biochemistry. In third year, specialized biomechanical courses dealing with biofluids and biomaterials are offered along with mechanical engineering design courses and organic chemistry. Fourth year allows you to further specialize in biomechanics and biomechanical device design. You will participate in a major biomedical capstone design project that further develops your quantitative and experimental skills in a team setting and provides outstanding practical experience.

Your future

With well-rounded training in mechanical engineering with a focus on biomedical applications, you will be qualified to work in the fields of medical devices, biomedical engineering, health services, diagnostic equipment, medical instruments and medical information systems. These industries are growing, in Canada and globally, and the demand for specialists is expected to increase. You will be well prepared for continued studies at the graduate level or at a medical school.

Safety first

The fourth-year Crash Dummy Project has students design and build a crash dummy and subject it to different accident scenarios. With sensing capabilities beyond those of commercially available crash test dummies, Carleton's dummy can predict a wider range of injuries, enabling the simulation and analysis of accident scenarios including automotive, bicycle, low- and high-impact falls, and sports injuries such as hockey cross-checking and football head-on collisions.

Professor David Lau's research involves the monitoring and assessment of large structures, including the Confederation Bridge. He uses data collected from more than 750 sensors built into the 12.9-kilometre bridge connecting Prince Edward Island and New Brunswick to track the structure's behaviour under ice forces, wind, earthquake, deformations, thermal stresses, corrosion and load.

Civil Engineering

Everything in our built environment—from towers reaching to the sky, to bridges spanning provinces, to dams holding back rivers—is the work of civil engineers who plan, design, build, maintain, rehabilitate and manage the infrastructure that houses people, moves goods and supplies power and water. Whether working on one-of-a-kind structures or the roads we drive every day, civil engineers make meaningful contributions to the development, evolution and safety of our physical world.

Your opportunities

- Explore structural, geo-technical and transportation engineering with a program of study that emphasizes problem-solving skills, laboratory experience, design and advanced computer methods for civil engineering.
- Access to excellent computer facilities and laboratories, such as a materials lab to assess properties of steel, concrete or soil, and a state-of-the-art strong floor facility for the testing of large-scale specimens.
- Develop contacts for future employment and access

Photo courtesy of Igor Milasin

Engineering students prepare their entry for the annual Troitsky Bridge Building Competition at Concordia University in Montreal. Competitors use skill and imagination to construct simple bridges from dental floss, popsicle sticks and glue. Entries are judged on aesthetics, originality, presentation and strength—some bridges can support more than 2,300 kg of force.

additional research and resource facilities through collaborative design projects with industry, government and other research agencies in the Ottawa region, including the National Research Council Canada.

Your program

You will develop a broad background in engineering in your first two years of study before specializing in:

- structural engineering—the construction and functioning of safe, reliable buildings and bridges, as well as the analysis and assessment of existing structures;
- transportation engineering—the planning and design of safer systems and facilities for traveling and transportation on land, by water or in the air;
- geotechnical engineering—the evaluation of subsurface soil and rock as building foundations or as the framework for structures such as tunnels and mines; or
- municipal engineering—the range of tasks handled by municipal governments, such as road or bridge maintenance, water and waste water treatment, waste management and urban planning.

Your future

You will be a highly skilled professional with the expertise in analysis, computer applications and design that is in demand from government and consulting engineering firms. You can plan and execute technically advanced civil engineering projects such as building and bridge construction, design and construction of runways and seaports, energy resource development and engineering for cold climates.

Hottest research

Professor George Hadjisophocleous, Canada's first Industrial Research Chair in fire safety engineering, is an internationally recognized expert in the field of fire safety. A combination of computer modeling and full-scale testing in the one-of-kind Fire Research Facility in Almonte, Ontario, allows Dr. Hadjisophocleous and his student researchers to examine how fire develops and spreads in buildings and tunnels, the toxic gases it produces, how fast it moves, how occupants behave and the effectiveness of fire detection and suppression systems.

You might also be interested in architectural conservation and sustainability.

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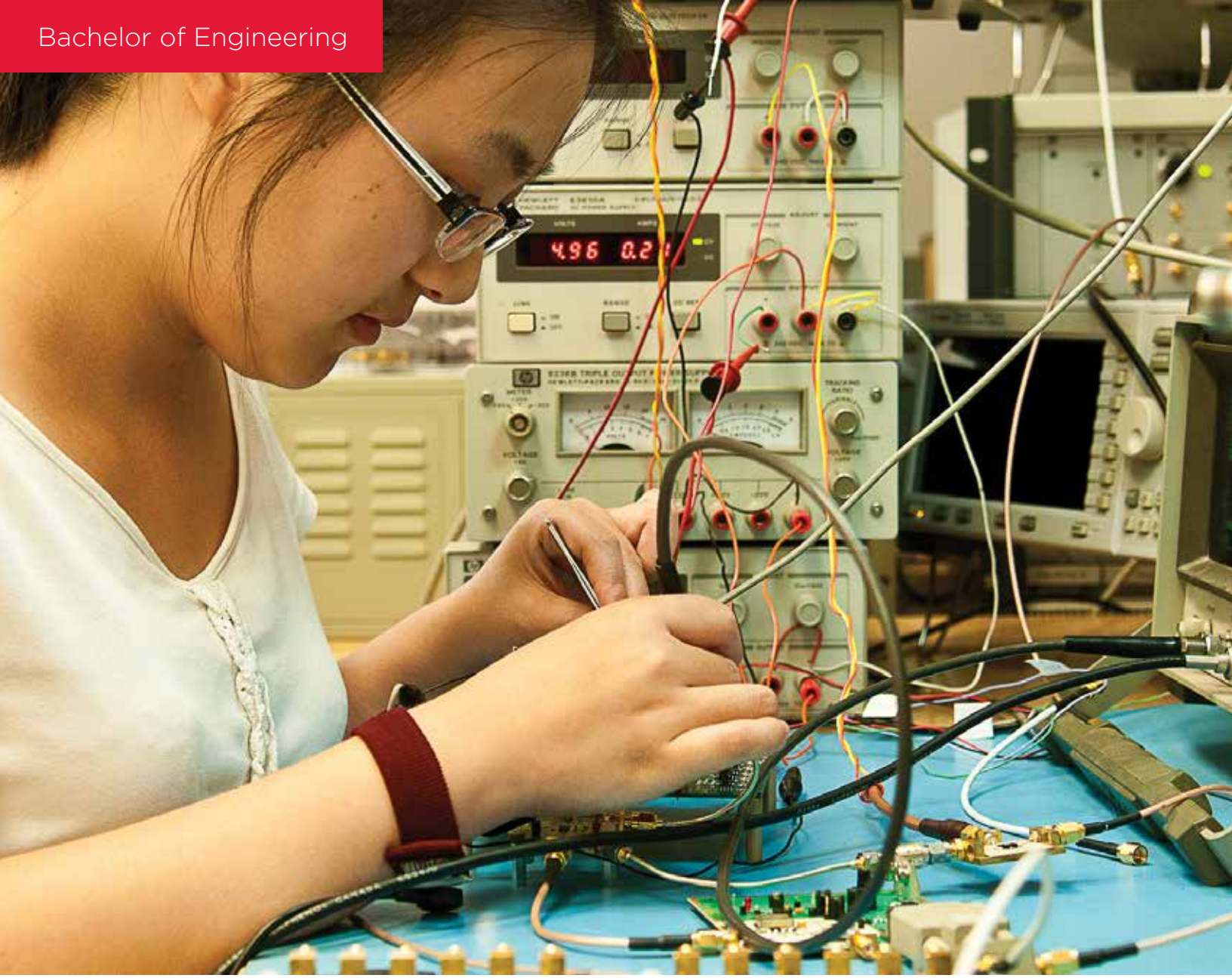
THE CAPITAL ADVANTAGE

The National Research Council Canada (NRC) is the country's scientific and industrial research agency. Based in Ottawa, the NRC helps turn ideas and knowledge into new products, processes and services. Outstanding government scientists and engineers work directly with partners from Carleton University and from industry. These collaborations mean that Carleton students enjoy access to the latest technology and research, especially in the areas of aerospace, hydraulics, information technology, transportation and micro-structural sciences.



Students perform communication system testing in the radio laboratory.

Communications Engineering

Communication engineers develop robust systems to support data transmission in applications such as social media, cloud computing and videoconferencing. They are responsible for planning, building and operating the communications and related distributed information systems that transmit signals essential for business, security and even entertainment.

As the architects and implementers of new generations of wireless systems, Internet applications, cloud computing, satellites, smart phones, social networking technologies, and integrated voice, data and video telecommunications, communications engineers play an important role in the world economy.

Your opportunities

- Gain real experience through co-op work placements, a final-year design project and integrated studies in the

principles and practice of telecommunications and related computer technologies.

- Access well-equipped laboratories and facilities sponsored by Alcatel, Texas Instruments, Huawei and TELUS for design work that emphasizes problem-solving skills and hands-on experience.
- Develop contacts for future employment through Carleton's close association with the laboratories of the federal Communications Research Centre, the National Research Council Canada and local technology companies.
- Learn from university, industry and government lecturers who are communications experts.

Your program

You'll gain a broad foundation in the basics of mathematics, physical sciences, and engineering sciences and technology. You'll have a strong background in real-time computer systems and software engineering through the study of communications theory and practice, design and analysis of telecommunications

components, systems, software, applications, and regulatory and social issues. The program provides you with the flexibility required to practice in a world of rapidly changing technology, and the specific knowledge and skills that employers in the telecommunications and information industries are looking for.

Your future

As a graduate of communications engineering, you will be well prepared for positions such as network architect, network manager, and product or protocol test engineer. In the telecommunications industry, you can work in research and development, manufacturing, installation, operational maintenance, protocols and new services testing, marketing, sales or management.

For the computer industry, you could engineer communications products, distributed computer networks and multimedia systems—and interface them with telecommunications facilities.

Communications engineers are in demand in the financial, transportation, hospitality and defence industries, government research and development laboratories, regulatory and licensing agencies, standards organizations and telecommunications service providers.

You might also be interested in software engineering or computer systems engineering.

Visit carleton.ca/cuuc for information on course and co-op education options.

- Progressive co-op education option
- Scholarships for high-standing students
- Accredited by the Canadian Engineering Accreditation Board

Computer Systems Engineering

Computer systems, particularly embedded microcontrollers and digital signal processors and related hardware, have become essential components in almost every area of modern life, from telecommunications and information networks to multimedia applications and real-time control systems, and from aerospace and satellite systems to mechatronics and robotics.

Computer systems engineers design complex computer systems—such as smart phones and communication networks, intelligent cars and smart highways—that can interact with one another to solve problems or improve productivity and keep us connected to the world around us.

Your opportunities

- Integrate studies in computer systems organization, software engineering, real-time systems, electronics, computer networking and general systems design.
- Engage in lab and design projects that emphasize problem-solving skills and hands-on experience in real-time systems or computer

sce.carleton.ca

Great grad

Wenbo Zhu, a recent Carleton University doctoral graduate (PhD/14), is a Software Engineer at Google. Having been with the company since 2007, he currently works on distributed systems and networking infrastructure and technologies. His many contributions include work on projects such as Google Servlet Engine, Google App Engine, and more recently Google's Cloud Platform.

You might also be interested in software or communications engineering.

Visit carleton.ca/cuuc for information on course and co-op education options.

- Progressive co-op education option
- Scholarships for high-standing students
- Accredited by the Canadian Engineering Accreditation Board

architecture in laboratories sponsored by Alcatel, Texas Instruments, Huawei and TELUS.

- Develop contacts for future employment through Carleton's close association with the laboratories of the Communications Research Centre, the National Research Council Canada and the local technology companies that make Ottawa a hub of high-technology. Companies and organizations tap into Carleton as a rich source of talent, ideas and expertise for research partnerships and future employees.

Your program

You will acquire a broad base of knowledge in science, mathematics, computers, and engineering science and design in first year. Over the next three years of the program, you will learn to engineer computer systems and acquire a deep understanding of computers as integrated software/hardware systems. You will become adept in object-oriented programming, real-time systems, software engineering, digital and analog electronics, linear systems, communications systems and networks, and telecommunications. Specialized topics (such as a focus on robotics or artificial intelligence) and an advanced research project round out the program.

Your future

As a computer systems engineer, you will work at the interface of hardware and software—and be able to design both—especially in the area of embedded and autonomous systems, microcontroller applications, telecommunications, and the engineering of computer-based systems. Graduates of the program are the founders of, and active leaders in, several high-tech companies specializing in computer systems and information networks.

Canada's computer-based systems industry is a contributor to the economy and is recognized worldwide for its technical and commercial success. Challenging career opportunities continue to be created as computer systems are integrated in new products and processes.

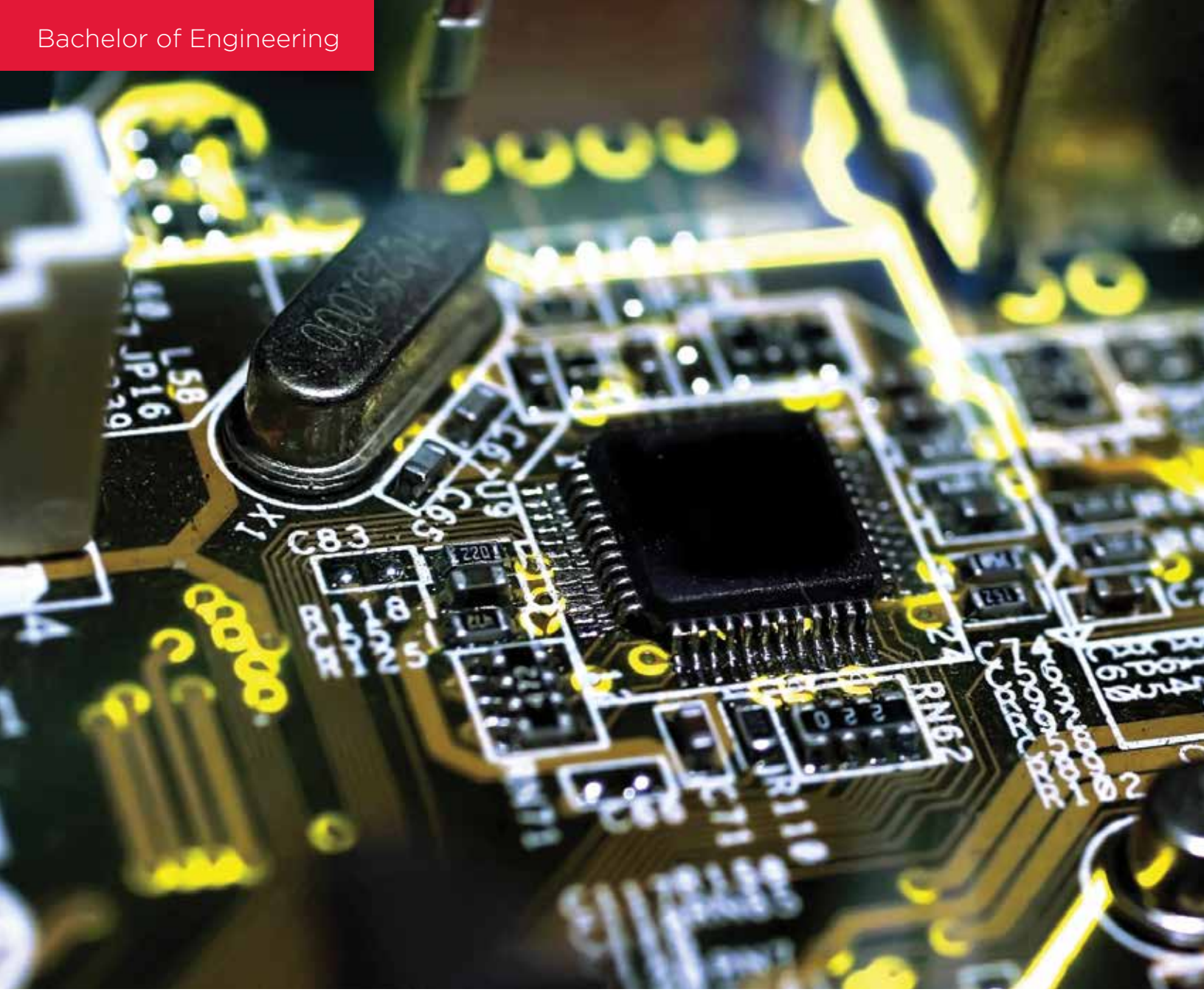
For your health

A talking fridge speaks up when the door is left open. Soft lights come on to guide the way from bedroom to bathroom in the middle of the night. A pressure-sensitive mat in the mattress lets doctors know if a patient has trouble getting out of bed.

These features in the Carleton-designed smart apartment at the Elisabeth Bruyère Hospital help prepare patients for release, but the technologies could also help older adults stay in their homes longer.

Rafik Goubran, dean of the Faculty of Engineering and Design, along with faculty members and student researchers, is developing and testing technologies that facilitate living and provide essential health and wellness information to health care providers.

This computer systems research is a partnership between Carleton, the Elisabeth Bruyère Research Institute, University of Ottawa and SCO Health Service.



Electrical Engineering

Electrical engineers are transforming civilization and society. Working in industry, government and academia, they create the light we read by, the devices we use to play our music, and the computers on which we work, game and socialize.

This revolution in lifestyle is achieved through the design of the largest and the smallest structures ever built by humans. Working with nano-scale devices smaller than most living cells, electrical engineers design the microchips used in larger devices from cellphones to satellites and supercomputers. This vast array of networked devices is powered by the largest man-made structure in the world: a massive grid, designed by electrical engineers, moves energy all over the world, creating light and heat, transporting people, irrigating land and powering phones and computers.

Your opportunities

- Specialize in wireless electronics, integrated circuit design and fabrication, nanotechnology,

green energy, biomedical sensors and technologies, antennas, light-wave devices, aerospace electronics, or design automation.

- Design your own integrated circuits in Carleton's on-campus fabrication facility—one of the few such facilities at a Canadian university.
- Access a superb undergraduate computing network with state-of-the-art workstations and computer-aided design tools in modern, well-equipped laboratories.
- Develop contacts for future employment through Carleton's close association with the largest government electrical engineering laboratories in Canada (including the Communications Research Centre Canada and the National Research Council Canada) and access to Ottawa's concentration of telecommunications and high-tech companies and leading hospital and medical research facilities, such as the University of Ottawa Heart Institute and the Children's Hospital of Eastern Ontario.

Your program

The first year of the Bachelor of Engineering program in electrical engineering emphasizes fundamentals in math and science. Second year introduces you to network analysis, electronic circuit design, object-oriented programming and numerical analysis, while continuing to develop a strong base of math and computer skills. Third year courses provide specialization in digital and analog circuit design, semiconductor device physics, electromagnetics and real-time programming.

Fourth year offers options for further development in areas such as wireless electronics, antennas, integrated circuit design, layout and fabrication, fibre optic communications, nano-electronics, sensors and sensing technology, solar cell/photovoltaic technology, power systems, aerospace electronics and computer-aided design for electronics engineering. A capstone project lets you apply your knowledge in a hands-on group research project.

- Progressive co-op education option
- Scholarships for high-standing students
- Accredited by the Canadian Engineering Accreditation Board

Your future

You can find employment with companies developing products and services in wireless electronics, biomedical electronics, instrumentation, mobile electronics, electrical power and smart grids, renewable energy systems, computer/game hardware, telecommunications and aerospace electronics.

You might also be interested in biomedical and electrical engineering or engineering physics.

Visit carleton.ca/cuuc for information on course and co-op education options.

Getting MuscleMate to market

The MuscleMate device could help people in physiotherapy to measure their progress, stroke victims to recover muscle function, body builders to target specific muscles, or amputees to control prosthetics. Created by electrical engineering students Mark Klibanov, Musabbir Khan, Amrita Sandhu and Nick Stupich under the supervision of Professor Leonard MacEachern, MuscleMate is worn like a blood-pressure cuff and uses electromyography (EMG) to detect tiny electrical signals generated by muscles in the wearer's arm. The signals are amplified, filtered and converted before being sent wirelessly to a smartphone or computer. From there, gesture recognition software detects intensity and frequency of the impulses to determine strength and actions such as wrist turning to control video game play.

After winning numerous departmental and IEEE awards, the fourth-year project team was the first recipient of the Carleton University Capstone Award, which funded the students for four months to help launch the project as a commercial venture.

A Carleton student examines a silicon wafer in our on-campus clean room, a microfabrication laboratory that facilitates integrated circuit design and testing.

Engineering Physics

A challenging and elite field that combines the strengths of physics and engineering, engineering physics applies fundamental physical science to the solution of technological problems and the development of new technology. Engineering physicists use a broad foundation in material science, applied physics, electronics and nanotechnology to develop new semiconductor devices, optical systems and nano-scale integrated devices for telecommunication, biomedical and renewable energy applications.

Your opportunities

- Specialize in integrated semiconductor devices and technology or optical devices and systems.
- Design your own integrated circuits in Carleton's on-campus fabrication facility—one of the few such facilities at a Canadian university.
- Gain real experience collaborating with a senior professor on a team project to design and implement an optical system—a unique experience in first year.

Many research-intensive government departments and agencies, including the National Research Council Canada, are located in the National Capital Region.

- Access superb computer networks and resources and modern, well-equipped laboratories such as the Canadian Photonics Fabrication Centre for the design, fabrication and testing of state-of-the-art photonics and optoelectronics components and systems.
- Develop contacts for future employment through Carleton's close association with Ottawa high-tech companies and the laboratories of the National Research Council Canada and the Communications Research Centre.

Your program

Your program begins with a broad and fundamental background in physics and electronics. During the first year, you have a unique opportunity to participate in a small class and collaborate closely with a senior professor on a team project to introduce you to engineering design early in your studies and make your subsequent years more relevant and interesting.

The second and third years of the program provide you with a strong background in physics and engineering, with courses in programming, electronics and modern physics. Fourth year allows you to specialize in either semiconductor device technology or applied optics. Electives are also available in integrated-circuit (IC) design, telecommunications electronics, computer-aided design, microwave engineering, integrated sensors and other areas.

Your future

As an engineering physicist, you will be well equipped to work in the biomedical, renewable energy and telecommunications high-technology sectors including IC fabrication, microelectronic devices, nanotechnology, microwave and optical systems, and sensor technology.

Some engineering physicists build careers in biomedical engineering and medical physics. This degree prepares you for graduate studies in electrical engineering or physics.

You might also be interested in electrical engineering or photonics and laser technology.

Visit carleton.ca/cuuc for information on course and co-op education options.

- Progressive co-op education option
- Scholarships for high-standing students
- Accredited by the Canadian Engineering Accreditation Board

Tiny solutions to big problems

Using silicon chips and photonics to detect and treat infectious diseases, Professor Winnie Ye is developing tomorrow's health and medical technologies today. Dr. Ye is a Carleton University graduate (BEng/00, PhD/07) who holds the Canada Research Chair in nano-scale IC design for reliable optoelectronics and sensors.

She makes Carleton her research home for some of the same reasons engineering and design students do: the university's partnerships with neighbouring technology companies and government institutions committed to advancing R&D, and one of the only campus clean rooms in Canada, which gives students firsthand experience in learning to fabricate semiconductor devices for biomedical, telecommunication and renewable energy applications.

Environmental Engineering

Environmental engineers ensure that we have clean water to drink, clean air to breathe, clean soil in which to grow crops, and clean energy to sustain our growth. From global challenges like climate change to local issues such as a safe and secure supply of drinking water, the goal of environmental engineering is to offer sustainable and green solutions, and to provide a clean and healthy environment.

By using engineering and science principles, environmental engineers design innovative treatment technologies to minimize our environmental footprint, develop clean energy sources and protect our ecosystem, resources and public health.

carleton.ca/cee

Your opportunities

- Gain real experience through co-op work placements, a challenging final-year design project, and courses that emphasize problem-solving skills and hands-on laboratory work.
- Access modern computer facilities and well-equipped laboratories that allow students, for example, to analyze the water quality of the Rideau River that flows past campus or assess the air quality in a classroom or bus stop on campus.

Instruments collect and transmit data, such as water runoff and temperature, from the roof of Carleton's canal building, to evaluate the effects of a green roof covered with plants and soil in contrast to concrete slabs, shingles or tiles.

- Develop contacts for future employment by participating in collaborative design projects with industry, government and research agencies in the Ottawa region and through Carleton's close association with the laboratories of Environment Canada, Health Canada and Natural Resources Canada.

Your program

One of only a few such programs in Canada, Carleton's program covers a range of topics from life-cycle analysis and environmental impact assessment to the design process in four broad areas: air pollution control; groundwater flow and contaminant transport; solid and hazardous waste management; and water and waste water treatment.

The program mixes fundamental concepts and theory with analysis and design. In first year, you study common core courses. In the second year, you begin program-specific courses and take additional courses in biology and chemistry. Third year teaches the unifying fundamental principles for the four areas outlined above. Fourth-year courses are applied and provide in-depth study and design in these areas.

Your future

As an environmental engineer, you will find employment opportunities in industry, municipalities, consulting firms, federal and provincial regulatory agencies, and research establishments. Your many career options include designing treatment technologies and facilities, developing clean energy alternatives, providing safe drinking water, improving air quality and assessing waste management strategies.

You might also be interested in sustainable and renewable energy engineering.

Visit carleton.ca/cuuc for information on course and co-op education options.

- Progressive co-op education option
- Scholarships for high-standing students
- Accredited by the Canadian Engineering Accreditation Board

Community Involvement

For her PhD thesis, Natalie Linklater (right) is researching the use of UV irradiation and alternative chemical disinfectants for water as greener alternatives to chlorine with (left) Professor Banu Örmeci, Canada Research Chair in wastewater treatment engineering. The work Natalie is doing in the lab can change the way Canada treats its water; outside the lab she is changing the way young people see engineering.

While earning her bachelor and master's degrees at Carleton, Natalie developed her leadership skills as a mentor for younger women interested in engineering and science as a volunteer with campus groups such as Go Eng Girl, Let's Talk Science, and Women in Science and Engineering. "I have a lot of fun sharing my passion for engineering with younger students," says Natalie.

She also worked with the Air and Waste Management Association to set up a student chapter, the Society of Environmental Engineering, Management, Development and Science (SEEDS), that runs a mini-course to introduce high-school students to the engineering processes of water treatment, waste management, composting, ground water protection, air pollution control and sustainability.

With more than 160 clubs and societies on campus, you can explore new interests with like-minded friends and contribute to the engineering community.

Carleton students have been participating in the Formula SAE event since 1998, with triumphs such as highest engine power, best use of computer simulation, and best fuel economy. In 2010, the project team shifted gears to focus on the Formula Hybrid competition and in 2012, Ravens Racing unveiled its first Formula Hybrid Race Car.

Mechanical Engineering

Almost anything that is built to move can be considered mechanical. Mechanical engineers use their understanding of science and engineering to analyze, design, manufacture and maintain mechanical systems in vehicles, aircraft, heating and cooling systems, manufacturing, energy plants, machinery, medical devices and terrestrial and extraterrestrial exploration.

One of the most versatile of the engineering disciplines, mechanical engineering opens the door to a vast range of career possibilities.

Your opportunities

- Gain real experience through challenging laboratory and design work, including a final-year design project, that emphasizes problem-solving skills, hands-on experience, and adaptation to changing technologies.
- Access outstanding computer facilities and

www.mae.carleton.ca

You might also be interested in biomedical and mechanical engineering.

Visit carleton.ca/cuuc for information on course and co-op education options.

campus laboratories, including wind tunnels, equipment for structural tests, facilities for material testing, laboratories to study thermodynamic and heat transfer phenomena, and fully equipped computer-aided design and prototype fabrication and testing facilities.

- Develop contacts for future employment through Carleton's close association and collaboration with National Research Council Canada laboratories and research institutes in the Ottawa region.

Your program

Your comprehensive study in one of Canada's largest mechanical engineering departments begins with the fundamentals of design and engineering sciences in dynamics, thermodynamics, solid mechanics, materials, fluid mechanics, heat transfer and control systems and robotics. Elective courses are available in noise control, energy conversion and power generation, manufacturing and production processes, aerodynamics and flight mechanics, vehicle engineering, spacecraft design, propulsion and biomedical engineering.

Your future

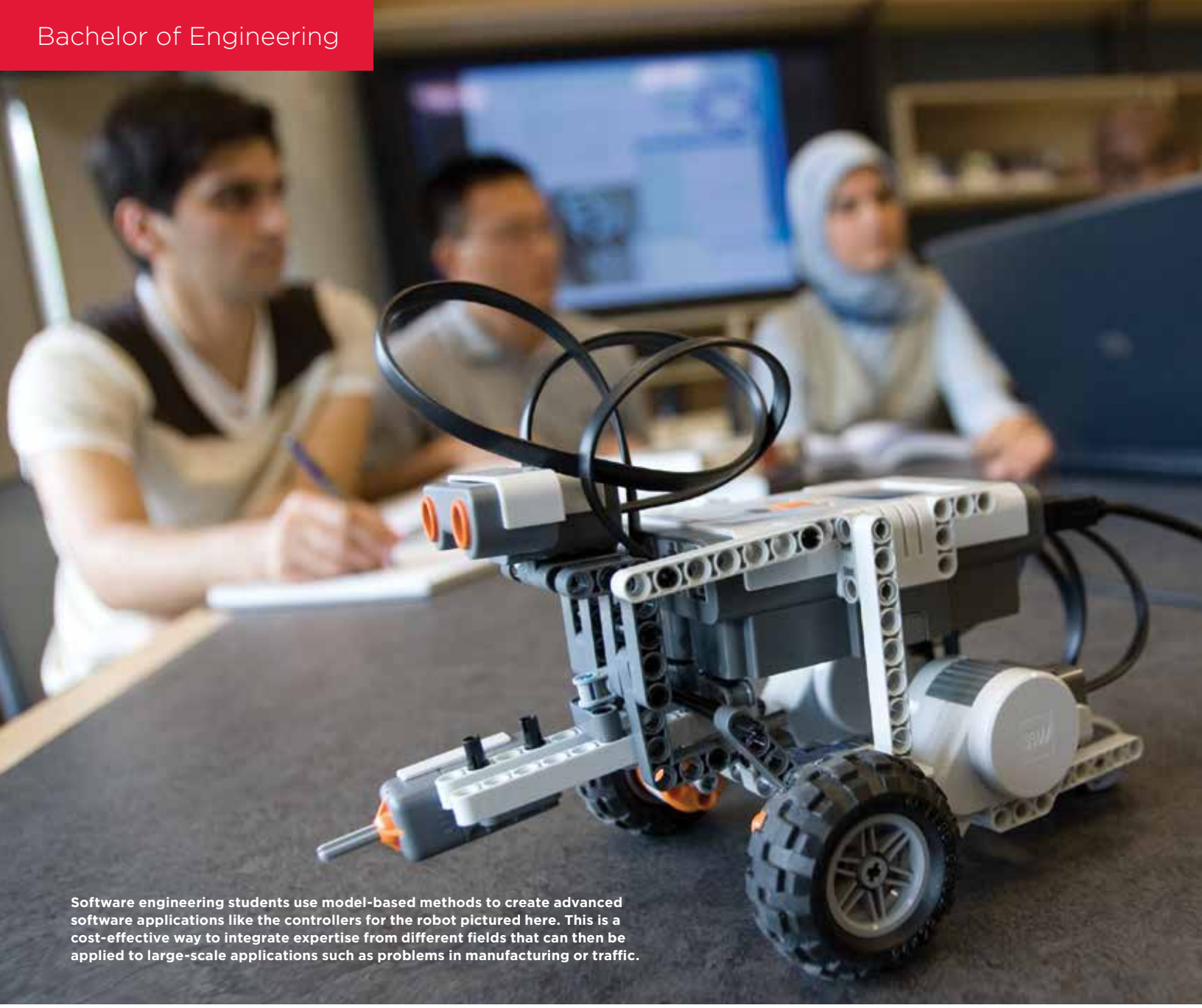
You will be able to adapt to changing technologies and work effectively in interdisciplinary team settings. Employment possibilities are broad, with challenging and rewarding opportunities in the manufacturing industry, energy utilities, industry and government laboratories, building services and plant engineering, the transportation industry and a variety of consulting engineering firms.

- Progressive co-op education option
- Scholarships for high-standing students
- Accredited by the Canadian Engineering Accreditation Board

Mars Rover

A team of mechanical and aerospace engineering students is working on a new micro-rover that could one day prowl the surface of Mars on exploratory research missions. The Kapvik micro-rover chassis, which weighs less than 30 kilograms, has been designed from the ground up by Carleton researchers.

The six-wheeled micro-rover may one day be used in unmanned planetary explorations as a scouting instrument that could accompany a larger rover. It is also capable of terrestrial exploration as a remote-controlled research platform in some of Earth's harshest environments. The project is being coordinated under the Canadian Space Agency.

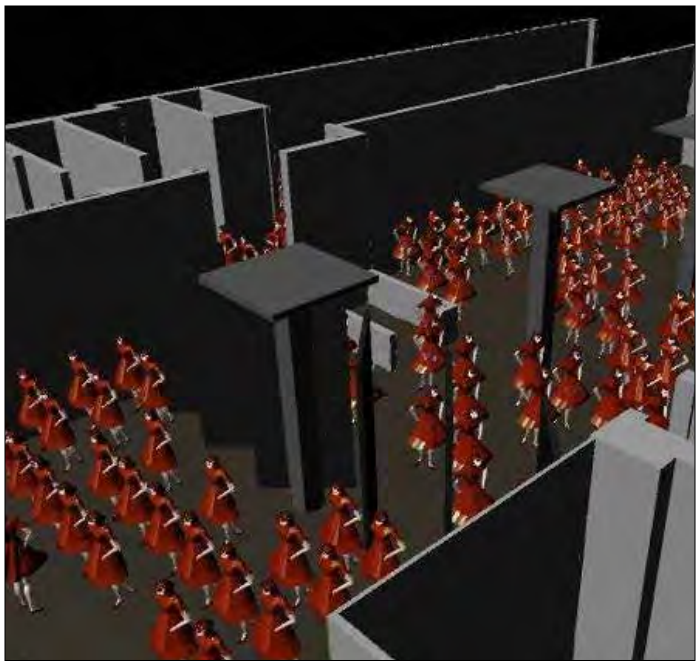


Software engineering students use model-based methods to create advanced software applications like the controllers for the robot pictured here. This is a cost-effective way to integrate expertise from different fields that can then be applied to large-scale applications such as problems in manufacturing or traffic.

Software Engineering

The phenomenal growth in computing, and the related information technology industry, has resulted in a tremendous demand for software engineers—people who are qualified to develop reliable, economical and high-quality software systems that provide the "brains" for hardware and bring to life the modern computer infrastructure that affects all aspects of our lives.

Much more than computer programming, software engineering offers comprehensive study in software security, reliability and quality, and creative solutions to meet the requirements of end-users. Software engineers help software to evolve, add new features and merge isolated software systems into cooperating systems in industries such as aircraft, satellite and air traffic control, banking, medical and imaging devices, and gaming.



Architecture and engineering students integrate advanced modeling tools and the 3D models pictured here to analyze problems such as fire evacuations of buildings.

Your opportunities

- Learn essential discipline components such as programming paradigms and design notations through integrated studies in the principles and practice of software systems development and related computer technologies.
- Access well-equipped laboratories and computer facilities for lab and design work that emphasizes problem-solving skills and hands-on experience, such as state-of-the-art software modeling and engineering techniques.
- Develop contacts for future employment through Carleton's close association with government-led laboratories, the National Research Council Canada and many local technology companies such as IBM and Ericsson.

Your program

You will learn fundamental computing theory and practice; processes, methods and tools for developing software systems; and regulatory and social aspects of development. You will acquire a solid foundation in mathematics, physical sciences, engineering principles and design. You will learn to design software rapidly—while maintaining the flexibility needed to accommodate future changes—and become increasingly specialized in object-oriented modeling (using the standard Unified Modeling Language notation) and programming (using C++ and Java), and real-time computer systems. A challenging final-year design project lets you apply your knowledge.

Your future

Prepared to specify, design, implement and maintain complex software systems, you will be in demand from public and private sectors in the areas of health care, aerospace, manufacturing, multimedia, information technology and telecommunication. You will be able to manage the development and deployment of software products such as embedded real-time systems in aircraft or medical devices, computer graphics and animation, online banking or e-commerce applications, multimedia and mobile computing systems, telephone switches and networks, routers, and database systems.

You might also be interested in computer systems engineering.

Visit carleton.ca/cuuc for information on course and co-op education options.

- Progressive co-op education option
- Scholarships for high-standing students
- Accredited by the Canadian Engineering Accreditation Board

The course progression of the software engineering program reflects a focus on software development and supports the co-op option. Every student completes the engineering project course to gain practical engineering design experience.

Wind turbines that harness the wind and solar panels that convert light from the sun to produce electricity are two technologies being developed and monitored in the search for sources of clean and renewable energy to supply the needs of future generations.

Sustainable and Renewable Energy Engineering

Our planet is in need of clean and renewable sources of energy such as wind, solar, geothermal, tidal and biomass—and we need to generate, distribute and use non-renewable energy resources more effectively, by minimizing environmental impact and ensuring they make a positive contribution to sustainable development.

As a field of study, sustainable and renewable energy engineering examines the challenges confronting modern society as it attempts to meet energy needs in an economically efficient, socially responsible and environmentally friendly manner.

Your opportunities

- Gain real experience through a final-year team design project, optional co-op work terms, and a program that emphasizes problem-solving skills, a professional focus, and hands-on laboratory work.
- Specialize in smart technologies for power generation and distribution, or efficient energy generation and conversion.
- Access state-of-the-art laboratories for combustion and air emissions, fuel cell development, thermodynamics/energy

www.mae.carleton.ca
www.doe.carleton.ca

conversion, power electronics and smart grids; a micro-fabrication facility for photovoltaics and power harvesting; a large-scale atmospheric boundary-layer wind tunnel for wind-farm performance studies; and a water channel for the study of hydropower technology.

- Develop contacts for future employment through Carleton's close association with Hydro Ottawa, Natural Resources Canada, Siemens, and housing developers.

Your program

Both streams of study—**smart technologies for power generation and distribution,** and **efficient energy generation and conversion**—provide a solid core of courses and laboratory work that prepare you for a successful professional career in industry and the public sector, or for further studies at advanced levels. Courses in basic and applied science, in combination with stream-specific topics such as electronics, smart-grid systems, heat transfer and thermodynamics, technology for generating and converting energy, and environmental issues will give you the technical and professional tools to deal with the challenges of the energy field.

Your future

You will be well prepared for challenging positions in energy-intensive industries and related government agencies, including power utilities, generation facilities, distribution networks, smart grids and the construction industry. You will be in demand by manufacturers of materials and equipment for renewable energy projects, the hybrid vehicle design industry and emerging service industries specializing in energy efficiency, to name a few.

- Progressive co-op education option
- Scholarships for high-standing students
- Accredited by the Canadian Engineering Accreditation Board

You might also be interested in mechanical, computer systems or electrical engineering.

Visit carleton.ca/cuuc for information on course and co-op education options.

Professor Cynthia Cruickshank (right) supervised and led Carleton's team, including students Michael Brown (middle) and Christopher Baldwin (left), in preparation for the 2013 Solar Decathlon – an international competition held in Irvine, California. As part of Team Ontario (joining Queen's University and Algonquin College), Carleton students and faculty worked together to design and build an energy efficient house. During the competition, Team Ontario scored first place in engineering, second place in affordability, and tied for the first place in hot water draws and energy balance. The team scored sixth place overall.

Bachelor of
Architectural Studies

Architectural Studies

Architecture is society's most public, visible art. It reflects culture and participates in shaping it. Architects have deep concern for society, culture and the urban environment, a passion for turning ideas into reality, the ability to think critically, and an appreciation for art and technology.

The study of architecture involves an exploration of many disciplines: the combination of skills in writing, drawing, model-making, photography, video, digital media and oral presentation; and the balancing of the demands of function, aesthetics, technology and economics.

Your opportunities

- Access excellent facilities including design studios with personal work space, fabrication facilities for woodworking, metal machining and welding, and an assembly room for models and full-scale projects.
- Access extensive computer facilities and academic resources such as a technical library and reading room, the David J. Azrieli Gallery for architectural exhibits, the Carleton University Immersive Media Studio (a research centre for modeling and visualization using immersive, digital and hybrid media), and the Carleton Solids and Light Tectonics Laboratory for the study of materiality in architecture.
- Learn from the world's great architecture and architects through Directed Studies Abroad (two- to four-week excursions), visiting critics

carleton.ca/architecture

First-year students take a free-hand drawing course and are introduced to various media and techniques through a wide range of studio and outdoor exercises.

You might also be interested in the engineering program in architectural conservation and sustainability.

Visit carleton.ca/cuuc for information on course and co-op education options.

studios and lectures, and the Forum Lecture Series at the National Gallery of Canada featuring speakers such as Arthur Erickson, Moshe Safdie and Jean-Marc Ibos.

- Explore areas such as furniture design, stage design, advanced painting and drawing through workshop courses.

Your program

In your first year of the Bachelor of Architectural Studies program, you will acquire the foundation for subsequent studies through an introduction to architecture, drawing, studio design, and multimedia applications, and general study in engineering, art history and the social sciences.

You will also work toward your major in one of the following areas of study:

- **design** for a professional career in architecture with an emphasis on design;
- **urbanism** to explore architecture in the context of the city or promote the stewardship of the built environment; or
- **conservation and sustainability** for the conservation of historical architecture and the principles of sustainable design.

You will take courses in architectural history and theory, urbanism, and technology and sustainability, and will draw your electives from other disciplines offered at Carleton.

Your future

Graduates of the Azrieli School of Architecture and Urbanism are at work around the world in fields as varied as building design, urban design, fashion design, filmmaking, computer animation, environmental/sustainable building consultation, project management and historical architectural preservation.

The BAS degree prepares you for graduate studies required to practice architecture in North America, or for a career in education, history, conservation, community advocacy, public policy, or a range of design fields.

- Progressive co-op education option
- Scholarships for high-standing students
- Educational requirements that qualify you for professional studies at the master's level

For a third-year project, BAS students designed and built outdoor dining pavilions using found objects and recyclable materials.

Bachelor of
Industrial Design

Will McDonald took first place in the 2012 Innovative Designs for Accessibility (IDeA) student competition that challenged Ontario undergraduate students to develop innovative, cost-effective and practical solutions to accessibility-related issues. Will's winning design is Accessible Tandem Cycling to provide an accessible cycling experience for wheelchair users.

Industrial Design

The form and function of almost all of the objects that surround us are the result of an elaborate process of design.

To meet the demands of mass manufacturing, industrial designers determine every aspect of a product. Working in teams, they examine the demand for particular products, the available materials, production methods, environmental impact, costs and whether the final product will meet the needs of prospective customers.

Your opportunities

- Access excellent facilities including design studios, photographic facilities, modeling and testing laboratories, wireless computing, and a mass-production/mould simulation laboratory and rapid prototyping equipment.
- Benefit from access to local medical and scientific research facilities, galleries, museums and a design workforce of more than 3,500 people.
- Develop contacts for future employment by working on projects with private- and public-sector partners. Past collaborators include SMART Technologies, Y Design Studio, CNIB, the Canadian Paralympic Foundation, and the National Capital Commission.
- Showcase your talent at the popular annual graduation exhibition that attracts visitors and industry employers.

Your program

This unique and hands-on program blends design studio with applied and social sciences. Industrial designers are visual thinkers: you will learn how to use your drawing and modeling abilities to communicate product concepts. Through progressive stages of design development, you will learn how these concepts evolve in relation to materials, technologies and manufacturing processes, ecological issues, and the users' abilities and perceptions.

The program begins with an introduction to the theory and practice of design, and

id.carleton.ca

Fourth-year student Ian Murchison developed a portable defibrillator with its own power source which could be used by medical professionals working in the field (for example, on earthquake rescue missions).

courses in mathematics, physics, psychology and economics. In second year, topics such as mass-production technology, ergonomics, perception and computer applications are presented, along with electives from architecture, business, computer science or engineering.

In third and fourth year, you will focus on design projects, making drawings, models and full-scale prototypes and testing their viability. Projects can include almost any imaginable commodity, from medical equipment and transportation devices to building components, tools and furniture.

A highlight of the year is the school's annual graduation exhibition in April. Open to the public, the exhibition showcases the projects of senior Industrial Design students, and illustrates their incredible range of design diversity and skill. The exhibition attracts potential employers from different facets of industry.

Your future

You can pursue an exciting career in industrial design, graphic design, exhibit design, packaging design or manufacturing. You could work as a design consultant or become part of an emerging class of design entrepreneurs. Carleton grads have worked with clients all over the world, including Power Athletics, Teknion, Lee Valley Tools, Umbra, Prada, Armani and Sony—to name just a few.

Great Grad

An international leader in the field of industrial design, Karim Rashid has consistently reshaped the world around him. The BID grad from 1982 has a signature futuristic style based on the belief that "each new product should replace three."

Karim regards his education at Carleton as integral to his career success. "I took courses in philosophy, journalism, engineering, marketing, language and architecture—very useful, because to design is to understand global issues. I consider my time there to be a very important part of my career."

You might also be interested in the Bachelor of Information Technology programs.

Visit carleton.ca/cuuc for information on course and co-op education options.

- Progressive co-op education option
- Scholarships for high-standing students

Bachelor of
Information Technology

Interactive Multimedia and Design program students at work in Carleton's motion capture laboratory.

Interactive Multimedia and Design

From video games and animated shorts to educational tools and interactive websites, interactive multimedia and design professionals determine the shape of digital media, design interfaces and script the way that users will interact with the products they create.

Specialist areas in the multimedia sectors are growing rapidly in North America, Asia and Europe, resulting in an increased demand for people with the expertise and skills that combine creativity, imagination and technology to create the next generation of multimedia-rich applications and products.

Your opportunities

- Blend college- and university-level study in this joint program between Carleton University and Algonquin College. You will

Top game designers in Canada

Carleton teams took first and second place in the Windows Phone Game Design category of the Microsoft Imagine Cup 2012 Canadian competition. Challenged to build a game that would use technology to help solve the toughest problems, the first-place IMD students tackled the impact of human activity on the planet with a game that highlights the importance of renewable energy sources and uses art style to show a shift between a polluted world and a clean world. The second-place winners developed a game that raises awareness and funds for a charity addressing world hunger through in-game advertising and game play.

Skye Gagne, Zara Tooth and Ryan Bottriel present their winning game.

You might also be interested in industrial design or architecture.

Visit carleton.ca/cuuc for information on course and co-op education options.

graduate with a Bachelor of Information Technology Degree and an Advanced Diploma of Applied Arts.

- Benefit from professors and instructors that have a strong understanding of the industry, track current, emerging and future trends, and are engaged in research on the leading edge of interactive multimedia.
- Access state-of-the-art laboratories, the latest technology and industry-standard equipment at both institutions.
- Develop contacts for future employment through co-op work and industry collaboration and showcase your talent at the popular annual exhibition that attracts a wide range of visitors including industry employers.

Your program

Suitable for students who are both artistically inclined and technologically adept, the Interactive Multimedia and Design program provides multidisciplinary education in digital media covering subject areas such as web design, 2D and 3D computer animation, game design and development, visual effects, graphic design, human-computer interaction (HCI) and project management.

Your education will focus on the entire design process: taking an idea from concept to design, prototyping, testing and delivery. As a student of today and a designer of tomorrow, you will gain practical experience and a strong theoretical foundation. You will learn how to realize the ideas that you imagine today, and determine what products are needed, how they are built and how people will use them.

Your future

Upon graduation you will be well equipped to work in and shape the digital world of the 21st century. With a degree-diploma combination, you have career opportunities in areas such as computer animation, video game design and development, user-interface design, digital video and audio effects, multimedia development, dynamic web application design, graphic design, and e-commerce.

- **Progressive co-op education option**
- **Scholarships for high-standing students**

This image of a BIT-themed F1 race car, created by student Grant Moore as part of a 3D-modeling term project, uses high-detail textures, animation rigging and advanced rendering techniques.

Bachelor of
Information Technology

Laryssa Sirko and Rutendo Zvirawa configure a multimedia network.

Network Technology

The information technology industry is fast-paced and constantly evolving. Computer networks that share resources and information are rapidly advancing and are crucial for every type of business enterprise and our daily lives. Networking professionals develop the theoretical knowledge and practical skills needed to address the IT issues of today—as well as those of the future.

A multidisciplinary education and practical experience in mobile networking, IT security issues, cloud computing, social networking and network management, and the physics of communications prepares students to design, install, operate and manage complex information networks such as those that make up the Internet.

Your opportunities

- Blend college- and university-level study in this joint program between Carleton University and Algonquin College. You will graduate with a Bachelor of Information Technology degree and an Advanced Diploma in Technology.
- Develop analytical problem-solving and hands-on practical skills in current IT systems and technologies in a program with a strong theoretical and industrial background.
- Benefit from professors and instructors who have a strong understanding of the industry and are engaged in research on the leading edge of networking.

- Access state-of-the-art laboratories and new facilities at both institutions, featuring the best technology available—such as smart classrooms and up-to-date networking equipment from Cisco.

Your program

In this multidisciplinary program you will build a strong theoretical foundation in networking technologies and learn all aspects of modern information networks, including the theory of, and hands-on experience with, the design, analysis and operation of various networks incorporating many transmission technologies.

You will study topics in network security, wireless mobile networks, network growth and evolution, and the role that information networks play in modern organizations. Additionally, you will take business and elective courses to round out your knowledge of the role of technology in society.

Your future

With a degree-diploma combination, you have career opportunities in a variety of interesting work environments in government, network design and management companies, finance companies, system integrators, telecom operators, educational institutions, and business enterprises requiring network design, management and operation. You will be prepared to write the Cisco Certified Network Associate and Professional certification exams, giving you industry-recognized certification that is in high demand in the job market.

- Progressive co-op education option
- Scholarships for high-standing students
- Certification exam preparation for Cisco Certified Network Associate and Cisco Certified Network Professional

You might also be interested in communications engineering.

Visit **carleton.ca/cuuc** for information on course and co-op education options.

Instructors, such as Professor Marc St-Hilaire (pictured), bring their passion for research into the classroom. Their investigations into stealthy worm attacks, Internet traffic flow or increasing the mobility of wireless devices help shape the capstone projects that you can undertake. The network design projects let you apply your knowledge in teams or as individuals under the direction of faculty members.

Get noticed by employers

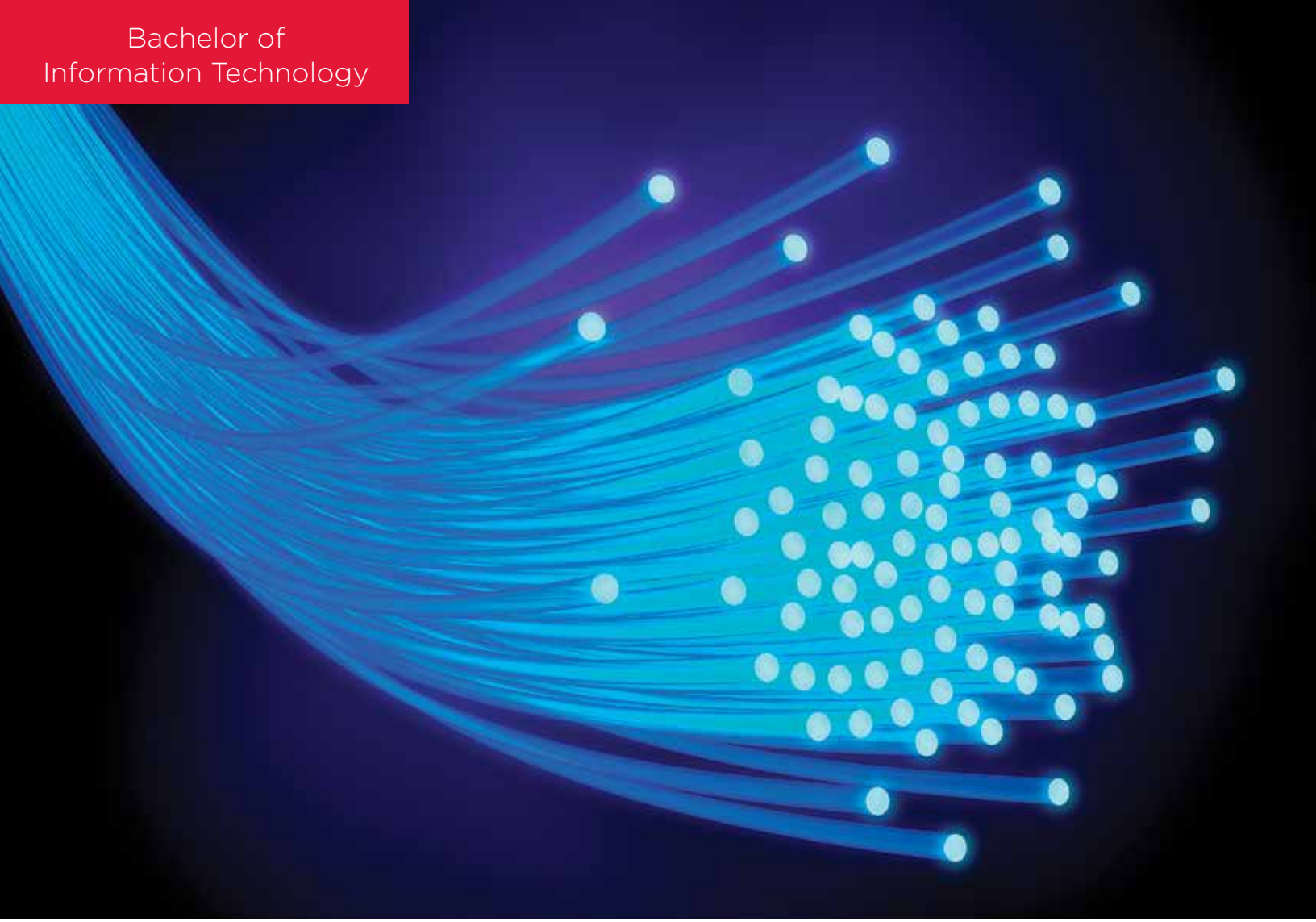
Carleton gives you lots of opportunity to do some professional networking and showcase your skills, including competitions involving the best students from across North America.

Network Technology students Carl Verge and Brian Wilson won first place in the Cisco NetRiders US and Canada Competition in 2010. Through a series of online exams and simulation activities, the pair demonstrated their networking/IT skills and gained visibility among recruiters in the growing ICT and networking fields.

"The BIT program gave us the necessary skills to do well in the competition," says Brian. "The program is well-rounded and provides practical experience."

As winners, the team took an all-expenses-paid trip, sponsored by Cisco, to San Jose, Calif., to meet information technology executives.

Bachelor of
Information Technology

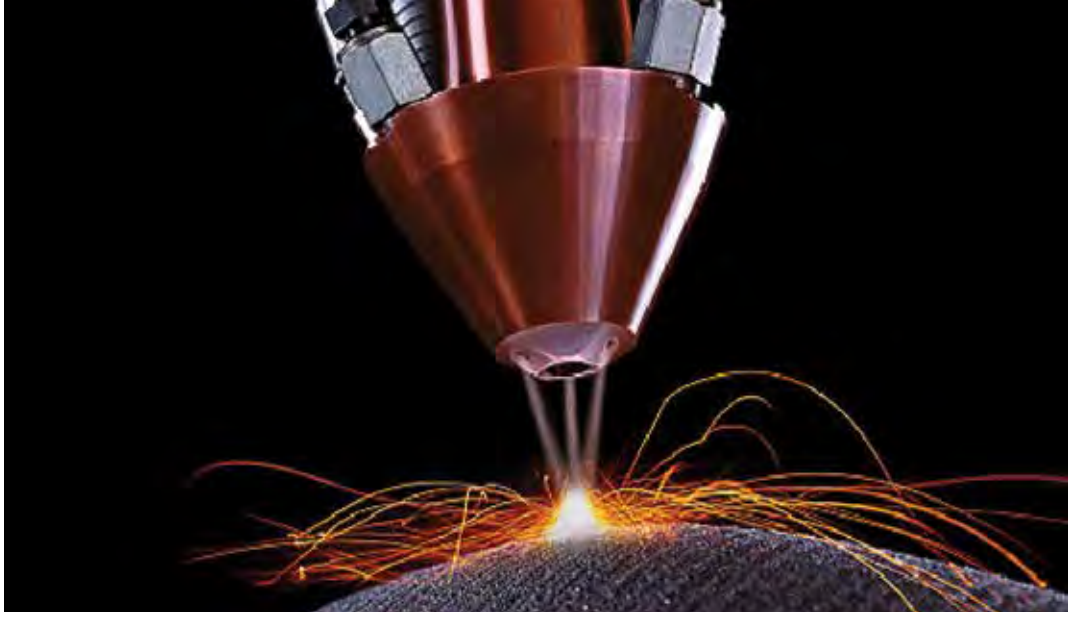


Photonics and Laser Technology

The impact of photonics in the 21st century will surpass the effect the Electronics Age had on our lives over the last 100 years. The science of generating and harnessing light has affected virtually all segments of society and industry, involving the ways we communicate, harness energy from the sun, manufacture automobiles and aircraft, measure our world (including important new medical instruments and laser-based therapies) and entertain ourselves with colourful displays in all sizes and shapes.

Your opportunities

- Blend college- and university-level studies in this joint program between Carleton University and Algonquin College. You will gain knowledge that is applicable in a variety of industries and graduate with both a Bachelor of Information Technology degree and an Advanced Diploma in Technology.
- Develop analytical problem-solving and hands-on practical skills in a program with a strong theoretical and industrial background.
- Benefit from professors and instructors who have a strong understanding of the industry and are engaged in research on the leading edge of photonics.
- Access state-of-the-art laboratories and computer facilities at both institutions, including an optical and semi-conductor fabrication facility, the Centre for Nanoscale Sensor Interfaces, and Algonquin's Advanced Technology Centre.



You might also be interested in electrical engineering.

Visit carleton.ca/cuuc for information on course and co-op education options.

Your program

At the start of the program you will develop a strong foundation in mathematics and physics before learning all aspects of photonics and lasers. Subjects covered include fundamentals of optics, theory of lasers, biophotonics, laser machining, holography, and fiber optic communications systems. You can expect extensive hands-on experience with relevant real-world photonics and advanced laser equipment.

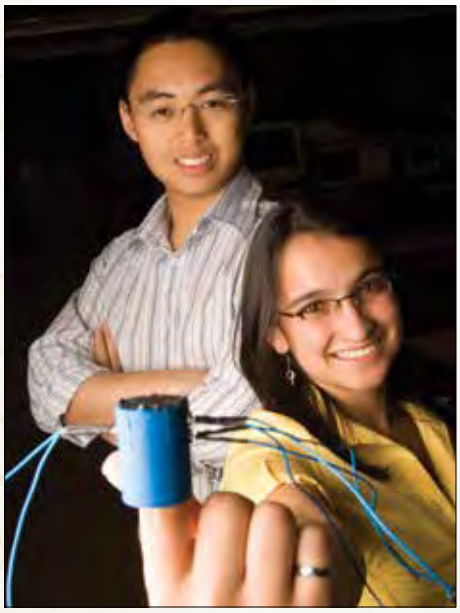
As a PLT student you will have the opportunity to take courses in humanities and business designed to round out your knowledge prior to embarking on your new career.

Your future

With a degree-diploma combination, you will have unparalleled career flexibility. Photonics technologies permeate education, research and private industry to the degree that the possible career paths available to you would be endless. Your future could be as varied as designing displays for next generation smart phones to developing life-changing laser-based surgical equipment.

- Progressive co-op education option
- Scholarships for high-standing students

Build a better device



Students in the photonics and laser technology program will team up to undertake a fourth-year project on a special topic of interest guided by a professor. A project like that of electrical engineering students Luz Osorio and Phong Nguyen is a great example of the power of light in creating medical devices. Luz and Phong created a pulse oximeter for their senior research project—it shines light through tissue and measures the rate of light absorption to determine blood oxygen levels.

"Our device has numerous applications," says Phong. "It can monitor patients during surgery or childbirth, or high performance athletes and pilots."

"This kind of project prepares you for a professional work environment in a very real way," says Luz. "The team has to pace itself well, divide up the work, submit progress reports and problem solve together over the course of the year."

For their innovative work, Luz and Phong won a departmental competition and a university-wide contest, and placed third competing against Eastern Ontario universities.

Making the Transition

Carleton University offers a network of support services to help you make a successful transition to university.

We can help you develop effective study skills, understand the university's academic regulations, choose or change programs, and find answers to your questions. You can participate in orientation sessions, meet with academic advisors, attend workshops on study strategies, sign up for leadership development programs and access our resource material—all strategies to help you achieve your academic and personal goals.

Asking for help and advice

Support services are in place specifically for Faculty of Engineering and Design students.

- The Undergraduate Academic Support Office provides engineering students with support and advice on schedules, registration and more. The comprehensive website carleton.ca/engineering/uas is a resource for all engineering students.
- Bachelor of Information Technology students use bitdegree.ca for information. Academic advisors from both Algonquin College and Carleton University are available to help.
- Architecture students get information on registration, suggested electives, announcements and events at carleton.ca/architecture. Staff can answer program questions and help with registration. Academic advisors are available by appointment.
- The School of Industrial Design's website id.carleton.ca is an important resource with information on registration, computer requirements, suggested electives, Orientation Week activities and more. Staff can help with questions and direct you for academic advice.

STUDENT ACADEMIC SUCCESS CENTRE

Programs offered through Carleton's centralized academic advising and learning support centre (carleton.ca/sasc) can help you with academic reading and note-taking, time and stress management, and multiple-choice and general exam preparation.

STUDENT EXPERIENCE OFFICE

Helping you adjust to university life and providing support throughout your degree, the Student Experience Office (carleton.ca/seo) offers a variety of programs, such as:

- Summer, Fall and Winter Orientation to bring students to campus for tours, information gathering and to meet other students;
- Community Service Learning initiatives to help students link what they learn in class to what they experience in the community;
- Leadership Development to provide opportunities to enhance your leadership skills; and
- Parent and Family Outreach to keep families informed of news and events.

UNIVERSITY REGISTRAR'S OFFICE

The Registrar's Office manages records, transcript requests, course registration and more. carleton.ca/registrar

Supportive facilities

MACODRUM LIBRARY

The library houses more than 3.4 million books, journals, government documents, maps, newspapers, music scores, CDs, microforms, archives and rare materials. Much of the collection is available online. In the library, you can connect to the wireless network or use the Laptop Loan program. During the fall/winter term, the library hours are extended to better accommodate students' needs. carleton.ca/library

PAUL MENTON CENTRE FOR STUDENTS WITH DISABILITIES

The centre coordinates academic and support services for students with disabilities. Services include academic accommodations, attendant services, alternate formats, adaptive technology, note-taking, sign language interpretation, and learning support and services specific to individual educational disability needs. carleton.ca/pmc

HEALTH AND COUNSELLING SERVICES

Carleton's multidisciplinary on-campus health care facility provides medical, counselling and health education services to the university's students, faculty and staff. carleton.ca/health

Future opportunities

THE WORKPLACE

A Carleton education prepares you for a career that will help to improve our society. Graduates of our well-recognized programs in engineering and design can be found living and working in Canada and around the globe.

We make sure you can graduate with work experience and a competitive edge. All our programs have co-op options that provide 12-20 months of work experience with more than 2,500 possible employers. In addition, our fourth-year projects provide unparalleled opportunities to explore your interests and creativity, and test your ideas and knowledge in real-world applications.

PROFESSIONAL PROGRAMS

Many programs, including law, teaching, medicine and business attract well-rounded applicants from a variety of academic backgrounds. The Faculty of Engineering and Design's programs are excellent preparation for such professional studies.

GRADUATE STUDIES

Many of our graduates continue with advanced university study at Carleton, in Canada or abroad for a master's degree or PhD. More information on Carleton's programs can be found at graduate.carleton.ca.

Great grad

As a high school student, Jenna Wiens participated in the Go Eng Girl program at Carleton, which introduced her to the engineering discipline. From there, she earned a Bachelor of Engineering from Carleton in 2008, winning the prestigious Governor General's Medal at graduation. She has since completed her Master's degree and her PhD at the Massachusetts Institute of Technology, one of the top ranked schools for studies in engineering, where she specialized in biomedical and electrical engineering. Today, Jenna is an Assistant Professor in EECS at the University of Michigan.

Engineering and Design graduate programs

Graduate Diploma in Architectural Conservation

Master of Applied Science
Aerospace Engineering*
Biomedical Engineering*
Civil Engineering*
Electrical and Computer Engineering*
Environmental Engineering*
Human-Computer Interaction**
Mechanical Engineering*
Sustainable Energy Engineering
Technology Innovation Management

Master of Architecture (Professional)

Master of Architectural Studies

Master of Design

Master of Engineering
Aerospace Engineering*
Civil Engineering*
Electrical and Computer Engineering*
Environmental Engineering*
Mechanical Engineering*
Sustainable Energy Engineering
Technology Innovation Management

Master of Infrastructure Protection and International Security
Joint program of the Department of Civil and Environmental Engineering and the Norman Paterson School of International Affairs

Doctor of Philosophy
Architecture
Aerospace Engineering*
Civil Engineering*
Electrical and Computer Engineering*
Environmental Engineering*
Mechanical Engineering*

**Joint program between Carleton University and the University of Ottawa*

***Joint program between the Schools of Information Technology and Computer Science and the Department of Psychology*

Ontario Admission Requirements

How to apply

All interested students must apply online through the Ontario Universities Application Centre (OUAC) website at **www.ouac.on.ca**. If you are presently finishing your last year of high school in Ontario, you must obtain log-in information from your school's guidance office before applying online.

For admission to undergraduate programs, Ontario students must have the Ontario Secondary School Diploma (OSSD) with six 4U/M courses. 4U English is recommended. 4U/M credits for out-of-class co-op work experience will not be considered as part of the six courses. **admissions.carleton.ca/requirements**

Degree program	Areas of study	Required prerequisite courses	Notes
Bachelor of Architectural Studies	• Conservation and Sustainability • Design • Urbanism	• English (ENG4U) • Physics (SPH4U) • Advanced Functions (MHF4U) (Calculus [MCV4U] recommended)	**Application deadline:** February 1. **Portfolio deadline:** April 1. Co-operative education available.
Bachelor of Engineering	• Aerospace* • Architectural Conservation and Sustainability** • Biomedical and Electrical* • Biomedical and Mechanical* • Civil* • Communications* • Computer Systems* • Electrical* • Engineering Physics* • Environmental* • Mechanical* • Software* • Sustainable and Renewable Energy* * Accredited by the Canadian Engineering Accreditation Board (CEAB). **New program designed to satisfy the accreditation requirements of the Canadian Engineering Accreditation Board (CEAB).	• Advanced Functions (MHF4U) • Chemistry (SCH4U) • Physics (SPH4U) • One credit from Calculus (MCV4U), Biology (SBI4U), or Earth and Space Science (SES4U) (Calculus [MCV4U] recommended)	English or French recommended. Co-operative education and internships available.
Bachelor of Industrial Design		• Advanced Functions (MHF4U) • Physics (SPH4U) (Calculus [MCV4U] and courses in visual arts and/or technological design are recommended)	**Application deadline:** March 1. **Portfolio deadline:** April 1. Information session recommended. Co-operative education available.
Bachelor of Information Technology	• Interactive Multimedia and Design	• One Math credit (4U)	Interactive Multimedia and Design **Application deadline:** March 1. **Portfolio deadline:** March 1. The program is not designed to accommodate part-time students. Co-operative education available.
	• Network Technology		Co-operative education available.
	• Photonics and Laser Technology	• Advanced Functions (MHF4U) • Physics (SPH4U) • One credit from Calculus and Vectors (MCV4U) (recommended), Chemistry (SCH4U) or Earth and Space Science (SES4U)	Co-operative education available.

If you are from outside Ontario, or outside Canada, see Carleton University's website at **carleton.ca/howtoapply** for specific program requirements for all bachelor programs.

Connect with Carleton

You can also get more information about Carleton—our programs, facilities and services—through the following:

UNDERGRADUATE ADMISSIONS WEBSITE

Everything a prospective student needs to know about Carleton University, including programs, campus life, co-op, scholarships and awards can be found here.
admissions.carleton.ca

STUDENT BLOGS

Get an inside look at life at Carleton. Students share their thoughts about campus life, their professors and programs, and the transition from high school to university.
carleton.ca/blogs

ASK CARLETON

You have questions and we have the answers. Visit our online databank of frequently asked questions anytime, day or night.
admissions.carleton.ca/ask

WATCH OUR VIDEOS

Visit our ever-expanding video gallery where you can view short videos on our campus, our residences, our co-op programs and more at: admissions.carleton.ca/videos

This document is available in a variety of accessible formats upon request. A request can be made on the Carleton University website at: carleton.ca/accessibility/request.

TAKE A TOUR

We encourage all prospective students and their families to visit our beautiful riverside campus. Book a tour online at carleton.ca/tours, by email at tours@carleton.ca or by phone at the Undergraduate Recruitment Office number listed on the back cover. If you can't visit us in person, you can explore our interactive campus map or take one of our program-specific virtual tours at admissions.carleton.ca/virtual-tours.

Insight

INSIGHT NEWSLETTER

Receive up-to-date news about Carleton University's undergraduate academic programs, upcoming on- and off-campus recruitment events and more. Register for our monthly newsletter.
carleton.ca/insight

Check out our Facebook page to learn more about future-student news and events, or to view photos from around the Carleton campus.
facebook.com/carletonfuture

Follow us on Twitter @carleton_future. You'll get all the latest news and announcements for future students.
twitter.com

Discover Carleton with our new Carleton Admissions mobile app for future students. The app is available for Apple and Android mobile devices.
admissions.carleton.ca/mobile-app

If you have any questions or wish further information, do not hesitate to contact us. Please see the back cover for our contact information.

Carleton
UNIVERSITY

Canada's Capital University

Undergraduate Recruitment Office, Carleton University, 315 Robertson Hall, 1125 Colonel By Drive
Ottawa ON K1S 5B6 Canada, Tel: 1-613-520-3663, Tel: 1-888-354-4414 (toll-free in Canada)
Email: liaison@carleton.ca

carleton.ca/engineering-design

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