Faculty of Engineering, including the Schools of Architecture and Urban Planning

Programs, Courses and University Regulations

2010-2011

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The web version is the most current version of this publication.

Not all courses are offered every year and changes can be made after publication. Always check the Minerv

1 About the Faculty of Engineering

The Faculty currently includes five engineering departments and two schools:

The Departments
Chemical Engineering
Civil Engineering and Applied Mechanics
Electrical and Computer Engineering
Mechanical Engineering
Mining and Materials Engineering

The Schools
Architecture
Urban Planning

The Faculty serves approximately 2,740 undergraduate students and 1,060 graduate students in a wide variety of academic programs.

Undergraduate programs leading to professional bachelor's degrees are offered in all engineering departments. These programs are designed to qualify graduates for immediate employment in a wide range of industries and for membership in the appropriate professional bodies. Additionally, a non-professional undergraduate degree is offered in the School of Architecture for those who plan to work in related fields not requiring professional qualification.

The curricula are structured to provide suitable preparation for those who plan to continue their education in postgraduate studies either at McGill or elsewhere. The professional degrees in Architecture and Urban Planning are offered at the master's level and are described in the *Graduate and Postdoctoral Studies Calendar* found at *www.mcgill.ca/students/courses/calendars*.

The academic programs are divided into required and complementary sections. The required courses emphasize those basic principles which permit graduates to keep abreast of progress in technology throughout their careers. Exposure to current technology is provided by the wide variety of complementary courses which allow students to pursue in depth a particular interest. For program details, refer to *section 11: Academic Programs*.

The Engineering Internship Program provides engineering students with the opportunity to participate in four-, eight-, twelve- or sixteen-month paid work experiences. Details can be found at *www.mcgill.ca/careers4engineers/students/internship*. In addition, co-op programs are offered in Mining Engineering and in Materials Engineering.

Postgraduate programs leading to master's and doctoral degrees are offered in all sectors of the Faculty. Numerous areas of specialization are available in each of the departments and schools. All postgraduate programs, including the professional degree programs in Architecture and in Urban Planning, are described in the *Graduate and Postdoctoral Studies Calendar* found at *www.mcgill.ca/students/courses/calendars*.

2 History of the Faculty

The Faculty of Engineering began in 1871 as the Department of Practical and Applied Science in the Faculty of Arts with degree programs in Civil Engineering and Surveying, Mining Engineering and Assaying, and Practical Chemistry. Diploma courses had been offered from 1859, and by 1871 the staff and enrolments had increased sufficiently to justify the creation of the Department. Continued growth led to the formation of the Faculty of Applied Science in 1878. By 1910 there were ten degree programs offered, including Architecture and Railroad Engineering. Subsequent changes in the overall pattern of the University led to the creation of the Faculty of Engineering in 1931 with a departmental structure very similar to that which exists at present.

3 Faculty of Engineering Facilities

3.1 Schulich Library of Science and Engineering

Second largest of the thirteen branches of the McGill Library, the Schulich Library of Science and Engineering provides resources and services to support the research and teaching programs in engineering and in the physical sciences. The Library holds more than 260,000 books, journals and other materials covering the spectrum of engineering and the physical sciences. There is also an extensive collection of online resources, with thousands of electronic journals, e-books and databases. Other branch libraries will be of interest to students in the Faculty of Engineering: Blackader-Lauterman Library of Architecture and

Art, Life Sciences Library, Macdonald Campus Library, Walter Hitschfeld Geographic Information Centre, Edward Rosenthall Mathematics and Statistics Library, and the Howard Ross Management Library.

The Schulich Library of Science and Engineering has over 100 networked computer workstations and the entire building is a McGill wireless zone. You may choose to work in the quiet or group study areas, and there are copy and print facilities on site. The Library provides support for users with disabilities, including wheelchair access and an adaptive workstation. The Library also offers a range of tours and workshops designed to help users effectively find, assess and use information.

Telephone: 514-398-7257
Faculty website: *www.mcgill.ca/engineering*

The Student Affairs Office and the Offices of the Associate Dean (Student Affairs) and Associate Dean (Academic) are located in the Engineering Student Centre:

3450 University Street
Montreal, Quebec H3A 2A7
Frank Dawson Adams Building, Suite 22

Professional
Bachelor of Software Engineering

Co-op Programs

Mining Engineering (B.Eng.)

General Engineering Program

General Engineering - Undeclared major (freshman year)

Major Programs

Architecture (B.Sc.)

Chemical Engineering (B.Eng.)

Civil Engineering (B.Eng.)

Computer Engineering (B.Eng.)

Electrical Engineering (B.Eng.)

Mechanical Engineering (B.Eng.)

Software Engineering (B.S.E.)

Honours Programs

Electrical Engineering (B.Eng.)

Mechanical Engineering (B.Eng.)

Minors

Arts

Biomedical Engineering

Biotechnology

Chemistry

Computer Science

Construction Engineering and Management

Economics

Environmental Engineering

Environment

Management Minors: Minor in Finance, Minor in Management, Minor in Marketing, Minor in Operations Management

Materials Engineering

MathematieeringB.Eng.)

- the opportunity to develop communication skills and to acquire a business perspective that cannot be learned in school.

An internship may begin in January, May or September. Employers choose the most suitable students for their organization through an application and interview process. While employed by the participating companies, you work on assignments related to your field of study. Internships will be recognized on your transcript as one or more non-credit courses entitled "Industrial Practicum." Successful completion of an internship of eight or more months qualifies you to graduate with the Internship Program designation on your transcript.

10.1 Student Eligibility

To participate in the Engineering Internship Program, you must

- have a CGPA of 2.00 or higher;
- be in good financial standing with the University;
- obtain approval from the Engineering Career Centre before registering for or starting your internship;
- be registered full-time in your program before and after your internship;
- remain a degree candidate while on internship;
- return to complete your undergraduate degree at McGill, with a minimum of 15 credits remaining in your program after your internship (i.e., you are not allowed to complete your degree during your internship).

Internship students will receive an automatic extension for the completion of their studies.

International students are eligible (a few restrictions may apply).

For more information, see *www.mcgill.ca/careers4engineers* or send an email to *careers4engineers@mcgill.ca*.

Important Information:

- While on internship, you are expected to complete any deferrals you may have been granted, regardless of the location of the internship. If you do not write a deferred exam as scheduled, you will receive a final grade of J. The J grade will calculate as a failure in both TGPA and CGPA.
- International students must ensure that their health coverage remains in force during their internship.
- During your time as an intern, you are not considered to be in full-time status. Your government loans will become due and payable within the prescribed grace period (usually six months).
- If you officially accept an internship position but subsequently decline the position, you will no longer be eligible for the Engineering Internship Program.

11 Academic Programs

The programs and courses in the following pages have been approved for the 2010-11 session as listed, but the Facultw2a health co

CHEM 120	(4)	General Chemistry 2
FACC 100	(1)	Introduction to the Engineering Profession
MATH 133	(3)	Linear Algebra and Geometry
MATH 140*	(3)	Calculus 1
MATH 141	(4)	Calculus 2
		Mechanics and Waves

11.2 School of Architecture

11.2.1 Location

Macdonald-Harrington Building, Room 201
815 Sherbrooke Street West
Montreal, Quebec H3A 2K6

Telephone: 514-398-6700
Fax: 514-398-7372
Website: *www.mcgill.ca/architecture*

11.2.2 About the School of Architecture

The School of Architecture at McGill University was founded in 1896. Our mission is to educate professionals who will contribute to the socio-economic and cultural development of Quebec, Canada and the broader global community through responsible participation in the process of the design, construction and interpretation of the built environment.

The School offers the non-professional B.Sc.(Arch.) program, the M.Arch. (Professional) program, and post-professional research programs, including the M.Arch. (Post-professional) and Ph.D.

11.2.3 Architectural Certification in Canada

In Canada, all provincial associations recommend a degree from an accredited professional deest

Laboratories and Workshops

Computers in Architecture Laboratories - Professor Aaron Sprecher

Library

Blackader-Lauterman Library of Architecture and Art, located in the Redpath Library - Marilyn Berger

Collections

Visual Resources Collection, including slides, film, video and other materials - Dr. Annmarie Adams

The John Bland Canadian Architecture Collection, housed in the Blackader-Lauterman Library - Ann Marie Holland, Preservations Librarian

Orson Wheeler Architectural Model Collection - Professor Pieter Sijpkes

Materials Resource Centre - Dr. Avi Friedman

Sc

Adjunct Professors

Joanna Nash

Mark Poddubiuk

Conor Sampson

Jozef Zorko

Planetary Society Visiting Professor in Architecture

Torben Berns

Course Lecturers

Tom Balaban

Sinisha Brdar

Nancy Dunton

Leila Marie Farah

Jean-François Fortin

Andrew King

Andrea MacElwee

Sybil McKenna

Suresh Perera

Carlos Rueda

Pierina Saia

Senior Critic

Dan Hanganu

Visiting Critics and Lecturers

Each year, visitors are involved in the teaching of certain courses as critics and lecturers. These visitors change from year to year. The following were visitors for 2009:

Diego Agudelo, Manon Asselin, Neeraj Bhatia, Mark Brightman, Mark Boutin, Randall Cohen, Youki Cropas, Jason Crow, Dana Cupkova, Nathalie Dln.aAe

Generally, students admitted to the Architecture program from Quebec CEGEPs are granted transfer credit for the Year 0 (Freshman) courses and enter a 100-credit (six-term) program.

For information on transfer credit for French Baccalaureate, International Baccalaureate exams, Advanced Placement exams, Advanced Levels and Science Placement Exams, see http://www.mcgill.ca/engineering/student/sao/newstudents/credit.

CHEM 110	(4)	General Chemistry 1
CHEM 120	(4)	General Chemistry 2
MATH 133	(3)	Linear Algebra and Geometry
MATH 140*	(3)	Calculus 1
MATH 141	(4)	Calculus 2
PHYS 131	(4)	Mechanics and Waves
PHYS 142	(4)	Electromagnetism and Optics

*Students may take MATH 139 (Calculus) instead of MATH 140, but only with permission from the Department of Mathematics and Statistics.

Required Non-Departmental Courses

15 credits

Note: Candidates intending not to proceed to the M.Arch. (Professional) degree may substitute other courses of equal total credit weight for any course with an asterisk (*) in the list below.

CIVE 284	(4)	Structural Engineering Basics
CIVE 385*	(3)	Structural Steel and Timber Design
CIVE 388*	(3)	Foundation and Concrete Design
CIVE 492*	(2)	Structures
FACC 220	(3)	Law for Architects and Engineers

Required Architectural Courses

70 credits

ARCH 201	(6)	Communication, Behaviour and Architecture
ARCH 202	(6)	Architectural Graphics and Elements of Design
ARCH 217	(1)	Freehand Drawing 1
ARCH 218	(1)	Freehand Drawing 2
ARCH 240	(3)	Organization of Materials in Buildings
ARCH 241	(3)	Architectural Structures
ARCH 242	(2)	Digital Representation
ARCH 250	(3)	Architectural History 1
ARCH 251	(3)	Architectural History 2
ARCH 303	(6)	Design and Construction 1
ARCH 304	(6)	Design and Construction 2
ARCH 321	(1)	Freehand Drawing 3
ARCH 322	(1)	Freehand Drawing 4
ARCH 324	(1)	Sketching School
ARCH 354	(3)	Architectural History 3
ARCH 355	(3)	Architectural History 4
ARCH 375	(2)	Landscape
ARCH 377	(3)	Energy, Environment and Buildings
ARCH 405	(6)	Design and Construction 3

ARCH 406	(6)	Design and Construction 4
ARCH 447	(2)	Lighting
ARCH 451	(2)	Building Regulations and Safety

11.3.5 Department of Chemical Engineering Faculty

Chair

Dimitrios Berk

Emeritus Professors

John M. Dealy; B.S.(Kansas), M.S.E., Ph.D.(Mich.), Eng.

Musa R. Kamal; B.S.(Ill.), M.S., Ph.D.(Carn. Mell), Eng.

Juan H. Vera; B.Mat.(Chile), Ing.Quim.(U.T.E.), M.S.(Calif., Berk.), Dr.Ing.(Santa Maria), Ing.

Professors

David G. Cooper; B.Sc., Ph.D.(Tor.)

Richard J. Munz; B.A.Sc., M.A.Sc.(Wat.), Ph.D.(McG.), Eng.

Alejandro D. Rey; B.Ch.Eng.(CCNY), Ph.D.(Calif., Berk.) (*James McGill Professor*)

Associate Professors

Dimitrios Berk; B.Sc.(Bosphorus), M.E.Sc.(W. Ont.), Ph.D.(Calg.), P.Eng.

Sylvain Coulombe; B.Sc., M.Sc.A.(Sher.), Ph.D.(McG.), Ing.

Reghan James Hill; B.Eng., Ph.D.(C'nell)

Richard L. Leask; B.A.Sc., M.A.Sc.(Wat.), Ph.D.(Tor.), P.Eng.

Milan Maric; B.Sc., B.Eng. & Mgmt(McM.), Ph.D.(Minn.), P.Eng.

Jean-Luc Meunier; Dipl.Ing., EPFL(Lausanne), M.Sc., Ph.D., INRS(Varennes), Ing.

Sasha Omanovic; Dipl.Ing., Ph.D.(Zagreb), P.Eng.

Thomas Quinn; B.Sc.(Qu.), S.M., Ph.D.(MIT)

Phillip Servio; B.Sc., Ph.D.(Minn.)

Assistant Professors

Elizabeth Jones; B.A.Sc.(Wat.), M.S., Ph.D.(Cal. Tech.)

Nathalie Tufenkji; B.Eng.(McG.), M.Sc., Ph.D.(Yale)

Viviane Yargeau; B.Eng., M.Sc.A., Ph.D.(Sher.), Ing.

Post-Retirement

W.J. Murray Douglas; B.Sc.(Qu.), M.S.E., Ph.D.(Mich.)

PAPRICAN Adjunct Professor

George J. Kubes; B.Eng., M.Eng.(Prague), Ph.D.(Bratislava)

Adjunct Professors

T. Addona

P. Bisaillon

M. Davidovsky

M. Fokas

D.J. McKeagan

B. McNicoll

A. De Mori

Adjunct Professors

M. Perrier

B.E. Sarkis

J. Simandl

B. Théorét

R.C. Urquhart

11.3.6 Bachelor of Engineering (B.Eng.) - Chemical Engineering (111 credits)

The discipline of chemical engineering is distinctive in being based equally on physics, mathematics and chemistry. Application of these three fundamental sciences is basic to a quantitative understanding of the process industries. Those with an interest in the fourth major science, biology, will find several courses in the chemical engineering curriculum which integrate aspects of the biological sciences relevant to process industries such as food processing, fermentation, biomedical and water pollution control. Courses on the technical operations and economics of the process industries are added to this foundation. The core curriculum concludes with process design courses taught by practising design engineers. Problem-solving, e

FACC 400	(1)	Engineering Professional Practice
MATH 262	(3)	Intermediate Calculus
MATH 263	(3)	Ordinary Differential Equations for Engineers
MATH 264	(3)	Advanced Calculus for Engineers
MIME 310	(3)	Engineering Economy

Required Chemical Engineering Courses

72 credits

CHEE 200	(4)	Introduction to Chemical Engineering
CHEE 204	(3)	Chemical Manufacturing Processes
CHEE 220	(3)	Chemical Engineering Thermodynamics
CHEE 291	(4)	Instrumental Measurement Laboratory
CHEE 310	(3)	Physical Chemistry for Engineers
CHEE 314	(4)	Fluid Mechanics
CHEE 315	(4)	Heat and Mass Transfer
CHEE 340	(3)	Process Modelling
CHEE 351	(3)	Separation Processes
CHEE 360	(1)	Technical Paper 1
CHEE 370	(3)	Elements of Biotechnology
CHEE 380	(3)	Materials Science
CHEE 392	(4)	Project Laboratory 1
CHEE 393	(5)	Project Laboratory 2
CHEE 423	(4)	Chemical Reaction Engineering
CHEE 453	(4)	Process Design
CHEE 455	(4)	Process Control
CHEE 456	(1)	Design Project 1
CHEE 457	(5)	Design Project 2
CHEE 462	(1)	Technical Paper 2
CHEE 474	(3)	Biochemical Engineering
CHEE 484	(3)	Materials Engineering

Technical Complementaries

9 credits

The purpose of this requirement is to provide students with an area of specialization within the broad field of chemical engineering. Alternatively, some students use the technical complementaries to increase the breadth of their chemical engineering training.

At least two courses (4-7 credits) must be chosen from the list below. The remaining courses(s) (2-5 credits) may be taken from other suitable undergraduate courses in the Faculty of Engineering, with departmental permission.

*Students may choose only one course in each of the following sets:

CHEE 494 or CHEE 495 or CHEE 496

CHEE 563 or MECH 563

CHEE 592 or MECH 534

CHEE 593 or CIVE 430

BIOT 505**	(3)	Selected Topics in Biotechnology
CHEE 363	(2)	Projects Chemical Engineering 1

MGPO 440	(3)	Strategies for Sustainability
MIME 308	(3)	Social Impact of Technology
PHIL 343	(3)	Biomedical Ethics
RELG 270	(3)	Religious Ethics and the Environment
SOCI 235	(3)	Technology and Society
SOCI 312	(3)	Sociology of Work and Industry
URBP 201	(3)	Planning the 21st Century City

Group B - Humanities and Social Sciences, Management Studies and Law

3 credits at the 200-level or higher from the following departments:

Anthropology (ANTH)

Economics (any 200- or 300-level course excluding ECON 208, ECON 217, ECON 227, and ECON 337)

History (HIST)

Philosophy (excluding PHIL 210 and PHIL 310)

Political Science (POLI)

Psychology (excluding PSYC 204 and PSYC 305, but including PSYC 100)

Religious Studies (RELG)

School of Social Work (SWRK)

Sociology (excluding SOCI 350)

OR one of the following:

ARCH 350	(3)	The Material Culture of Canada
BUSA 465*	(3)	Technological Entrepreneurship
ENVR 203	(3)	Knowledge, Ethics and Environment
ENVR 400	(3)	Environmental Thought
FACC 220	(3)	Law for Architects and Engineers
FACC 500	(3)	Technology Business Plan Design
FACC 501	(3)	Technology Business Plan Project
INDR 294*	(3)	Introduction to Labour-Management Relations
MATH 338	(3)	History and Philosophy of Mathematics
MGCR 222*	(3)	Introduction to Organizational Behaviour
MGCR 352*	(3)	Marketing Management 1
MRKT 360*	(3)	Marketing of Technology
ORGB 321*	(3)	Leadership
ORGB 423*	(3)	Human Resources Management

*Note: Management courses have limited enrolment and registration dates. See Important Dates at http://www.mcgill.ca/importantdates.

Language Courses

If you are not proficient in a certain language, 3 credits will be given for one 6-credit course in that language.

However, 3 credits may be given for any language course that has a sufficient cultural component. You must have this course approved by a faculty adviser.

11.3.6.1 More about the B.Eng. Degree in Chemical Engineering

Courses CHEE 582 and CHEE 584 comprise a Polymeric Materials sequence. Additional courses in this area are available in the Chemistry Department (e.g., CHEM 455) or at the graduate level (CHEE 681 to CHEE 684). The Department has considerable expertise in the polymer area.

Courses CHEE 370 and CHEE 474 make up a sequence in Biochemical Engineering1 0 L502 gel (CHEE 68.638 1ering1 0 L502-.ous Srtmence Maesimites in this ar5.4

courses in biochemistry and microbiology. The food, beverage and pharmaceutical industries are large industries in the Montreal area and these courses are relevant to these industries and to the new high-technology applications of biotechnology.

The third area in which there is a sequence of courses is Pollution Control. The Department offers three courses in this area: CHEE 591, CHEE 592, and CHEE 593. As some water pollution control problems are solved by microbial processes, course CHEE 474 is also relevant to the pollution control area. Additional courses in this area are listed under *Bachelor of Engineering (B.Eng.) - Minor Environmental Engineering (22 credits),* *section 11.10.8: Environmental Engineering Minor*.

A Minor in Biotechnology is also offered in the Faculties of Engineering and of Science with emphasis on molecular biology and chemical engineering processes. A full description of the program appears under *section 11.10.3: Biotechnology Minor*.

Note that many of the technical complementaries are offered only in alternate years. Students should, therefore, plan their complementaries as far ahead as possible. With the approval of the instructor and academic adviser, students may take graduate (500-level) CHEE courses as technical complementaries.

11.4 Department of Civil Engineering and Applied Mechanics

11.4.1 Location

Macdonald Engineering Building, Room 492
817 Sherbrooke Street West
Montreal, Quebec H3A 2K6

Telephone: 514-398-6860
Fax: 514-398-7361
Website: *www.mcgill.ca/civil*

11.4.2 About the Department of Civil Engineering and Applied Mechanics

Civil engineers have traditionally applied scientific and engineering knowledge to the task of providing the built environment, from its conception and planning to its design, construction, maintenance and rehabilitation. Examples include buildings, bridges, roads, railways, dams, and facilities for water supply and treatment, and waste disposal. With the aging and deterioration of an already vast infrastructure, its maintenance and rehabilitation has become an increasingly important role of the ci

Emeritus Professors

M. Saeed Mirza; B.Eng.(Karachi), M.Eng., Ph.D.(McG.), F.A.C.I., F.E.I.C., F.C.S.C.E., Hon. F.I.E.P., Eng.

Richard G. Redwood; B.Sc.(Eng.)(Brist.), M.A.Sc.(Tor.), Ph.D.(Brist.), F.C.S.C.E., F.I.Struct.Eng., Eng.

Stuart B. Savage; B.Eng.(McG.), M.S.Eng.(Cal. Tech.), Ph.D.(McG.), F.R.S.C.

Professors

61 credits

CIVE 202	(4)	Construction Materials
CIVE 205	(3)	Statics
CIVE 206	(3)	Dynamics
CIVE 207	(4)	Solid Mechanics
CIVE 208	(3)	Civil Engineering System Analysis
CIVE 210	(2)	Surveying
CIVE 225	(4)	Environmental Engineering
CIVE 290	(3)	Thermodynamics and Heat Transfer
CIVE 302	(3)	Probabilistic Systems
CIVE 311	(4)	Geotechnical Mechanics
CIVE 317	(3)	Structural Engineering 1
CIVE 318	(3)	Structural Engineering 2
CIVE 319	(3)	Transportation Engineering
CIVE 323	(3)	Hydrology and Water Resources
CIVE 324	(3)	Construction Project Management
CIVE 327	(4)	Fluid Mechanics and Hydraulics
CIVE 418	(4)	Design Project
CIVE 432	(1)	Technical Paper

Complementary Courses

21 credits consisting of:

Technical Complementary Courses

15 credits from List A and List B

Complementary Studies

6 credits from Group A and Group B

List A - Design Technical Complementaries

6-15 credits from the following:

CIVE 416	(3)	Geotechnical Engineering
CIVE 421	(3)	Municipal Systems
CIVE 428	(3)	Water Resources and Hydraulic Engineering
CIVE 430	(3)	Water Treatment and Pollution Control
CIVE 462	(3)	Design of Steel Structures
		Design of Concretef1 0 0es

CIVE 470	(3)	Undergraduate Research Project
CIVE 512	(3)	Advanced Civil Engineering Materials Renovation and Preserv

Economics (any 200- or 300-level course excluding ECON 208, ECON 217, ECON 227 and ECON 337)

History (HIST)

Philosophy (excluding PHIL 210 and PHIL 310)

Political Science (POLI)

Psychology (excluding PSYC 204 and PSYC 305, but including PSYC 100)

Religious Studies (RELG)

School of Social Work (SWRK)

Sociology (excluding SOCI 350)

OR one of the following:

ARCH 350	(3)	The Material Culture of Canada
BUSA 465*	(3)	Technological Entrepreneurship
ENVR 203	(3)	Knowledge, Ethics and Environment
ENVR 400	(3)	Environmental Thought
FACC 220	(3)	Law for Architects and Engineers
FACC 500	(3)	Technology Business Plan Design
FACC 501	(3)	Technology Business Plan Project
INDR 294*	(3)	Introduction to Labour-Management Relations
MATH 338	(3)	History and Philosophy of Mathematics
MGCR 222*	(3)	Introduction to Organizational Behaviour
MGCR 352*	(3)	Marketing Management 1
MRKT 360*	(3)	Marketing of Technology
ORGB 321*	(3)	Leadership
ORGB 423*	(3)	Human Resources Management

* Note: Management courses have limited enrolment and registration dates. See Important Dates at http://www.mcgill.ca/importantdates/

Language Courses

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However, 3 credits may be given for any language course that has a sufficient cultural component. You must have this course approved by a faculty adviser.

11.5 Department of Electrical and Computer Engineering

11.5.1 Location

Department of Electrical and Computer Engineering
Undergraduate Programs Office
Lorne Trottier Building, Room 2060
3630 University Street
Montreal, Quebec H3A 2B2

Telephone: 514-398-3943
Fax: 514-398-4653
Website: *www.mcgill.ca/ece*

11.5.2 About the Department of Electrical and Computer Engineering

The Department of Electrical and Computer Engineering offers undergraduate degree programs in Electrical Engineering, Electrical Engineering (Honours), Computer Engineering, and Software Engineering. All programs provide students with a strong background in mathematics, basic sciences, engineering science, engineering design and complementary studies, in conformity with the requirements of the Canadian Engineering Accreditation Board (CEAB).

In addition to technical complementary courses, students in all three programs take general complementary courses in humanities and social sciences and/or management studies and law. These courses allow students to develop specific interests in areas such as psychology, economics, management or political science.

11.5.3 Department of Electrical and Computer Engineering Faculty

Chair

David V. Plant

Associate Chair, Operations

Benoit Boulet

Associate Chair, Undergraduate Studies

Jonathan P. Webb

Associate Chair, Graduate Studies

Mark Coates

Emeritus Professors

Eric L. Adler; B.Sc.(Lond.), M.A.Sc.(Tor.), Ph.D.(McG.), F.I.E.E.E., Eng.

Pierre R. Bélanger; B.Eng.(McG.), S.M., Ph.D.(MIT), F.I.E.E.E., Eng.

Maier L. Blostein; B.Eng., M.Eng.(McG.), Ph.D.(Ill.), F.I.E.E.E., Eng.

Clifford H. Champness; M.Sc.(Lond.), Ph.D.(McG.)

Gerry W. Farnell; B.A.Sc.(Tor.), S.M.(MIT), Ph.D.(McG.), F.I.E.E.E., Eng.

Lorne Mason; B.Eng., Ph.D.(Sask.)

Tomas J.F. Pavlasek; B.Eng., M.Eng., Ph.D.(McG.), Eng.

Nicholas C. Rumin; B.Eng., M.Sc., Ph.D.(McG.), Eng.

Professors

Peter E. Caines; B.A.(Oxf.), D.I.C., Ph.D.(Lond.), F.R.S.C., F.I.E.E.E., F.C.I.A.R. (*James McGill Professor*) (*Macdonald Professor*)

James Clark; B.A.Sc., Ph.D.(Br. Col.), *Associate Dean, Academic*

Frank Ferrie; B.Eng., Ph.D.(McG.)

Francisco D. Galiana; B.Eng.(McG.), S.M., Ph.D.(MIT), F.I.E.E.E., Eng.

Vincent Hayward; Dip.Ing.(ENSM, Nantes), Doc.Ing.(Orsay), Eng.

Geza Joos; B.Sc.(C'dia), M.Eng., Ph.D.(McG.) (*CRC Chair*)

Peter Kabal; B.A.Sc., M.A.Sc., Ph.D.(Tor.)

Tho Le-Ngoc; M.Eng.(McG.), Ph.D.(Ott.), F.I.E.E.E.

Harry Leib; B.Sc.(Technion), Ph.D.(Tor.)

Martin D. Levine; B.Eng., M.Eng.(McG.), Ph.D.(Lond.), F.C.I.A.R., F.I.E.E.E., Eng.

David A. Lowther; B.Sc.(Lond.), Ph.D.(C.N.A.A.), F.C.A.E., Eng. (*James McGill Professor*)

Boon-Teck Ooi; B.E.(Adel.), S.M.(MIT), Ph.D.(McG.), Eng.

David V. Plant; M.S., Ph.D.(Brown), P.Eng., F.I.E.E.E., F.O.S.A., F.C.A.E. (*James McGill Professor*)

Gordon Roberts; B.A.Sc.(Wat.), M.A.Sc., Ph.D.(Tor.), Eng., F.I.E.E.E. (*James McGill Professor*)

Jonathan Webb; B.A., Ph.D.(Cant.)

Associate Professors

Ramesh Abhari; M.A.Sc.(Tehran), Ph.D.(Tor.)

Associate Professors

Tal Arbel; M.Eng., Ph.D.(McG.)

Jan Bajcsy; B.Sc.(Harv.), M.Eng., Ph.D.(Prin.)

Benoit Boulet; B.Sc.(Laval), M.Eng.(McG.), Ph.D.(Tor.) (*William Dawson Scholar*)

Benoit Champagne; B.Eng., M.Eng.(Montr.), Ph.D.(Tor.)

Lawrence Chen; B.Eng.(McG.), M.A.Sc., Ph.D.(Tor.)

Mark Coates; B.Eng.(Adel.), Ph.D.(Camb.)

Jeremy R. Cooperstock; B.Ap.Sc.(Br. Col.), M.Sc., Ph.D.(Tor.)

Mourad El-Gamal; B.Sc.(Cairo), M.Sc.(Nashville), Ph.D.(McG.) (*William Dawson Scholar*)

Dennis Giannacopoulos; M.Eng., Ph.D.(McG.)

Warren Gross; B.A.Sc.(Wat.), M.A.Sc., Ph.D.(Tor.)

Roni Khazaka; M.Eng., Ph.D.(Car.)

Andrew Kirk; B.Sc.(Brist.), Ph.D.(Lond.), *Associate Dean, Research and Graduate Education* (*William Dawson Scholar*)

Fabrice Labeau; M.S., Ph.D.(Louvain)

Shie Mannor; B.A., B.Sc., Ph.D.(Haifa)

Steve McFee; B.Eng., Ph.D.(McG.)

Hannah Michalska; B.Sc., M.Sc.(Warsaw), Ph.D.(Lond.)

Milica Popovich; B.Sc.(Colo.), M.Sc., Ph.D.(N'western)

Ioannis Psaromiligkos; B.Sc.(Patras), M.Sc., Ph.D.(Buffalo)

Richard Rose; B.Sc., M.S.(Ill.), Ph.D.(GIT)

Ishiang Shih; M.Eng., Ph.D.(McG.)

Zeljko Zilic; B.Eng.(Zagreb), M.Sc., Ph.D.(Tor.)

Assistant Professors

Vamsy Chodavarapu; B.Eng.(India), M.S., Ph.D.(NYU)

Anas Hamoui; M.Eng.(McG.), Ph.D.(Tor.)

Odile Liboiron-Ladouceur; M.Sc., Ph.D.(Col.)

Zetian Mi; B.A.Sc.(China), M.Sc.(Iowa), Ph.D.(Mich.)

Sam Musallam; B.Sc., M.Sc., Ph.D.(Tor.)

Michael Rabbat; B.S.(Ill.), M.S.(Texas), Ph.D.(Wis.)

Martin Rochette; B.A., M.Eng., Ph.D.(Laval)

Thomas Szkopek; B.A.Sc., M.A.Sc.(Tor.), Ph.D.(Calif.-LA)

Mai Vu; M.S., Ph.D.(Stan.)

Associate Members

Gregory Dudek; B.Sc.(Qu.), M.Sc., Ph.D.(Tor.)

Alan C. EvLond.eeds1 0 0 1 70.52 171.0855m(W)Tj1 0 0 1 77.518 584.0855m(W)Tjm DawsoR. FunnelEng., Ph.D.(McG.)Hannahenri B.a L. G-LAanang., Ph.D.(Mc

Associate Members

Nathaniel J. Quitoriano; B.S.(Calif.), Ph.D.(MIT)

Adjunct Professors

Ray Bartnikas

Eric Boisvert

Charalambos Charalambous

Robert DiRaddo

Danny Grant

Cedric Guss

Cheng K. Jen

Irene Leszkowicz

Miguel Marin

Douglas O'Shaughnessy

Katarzyna Radecka

Farouk Rizk

Anthony Rodolakis

Robert Sabourin

Leszek Szczecinski

Kenneth D. Wagner

11.5.4 Bachelor of Engineering (B.Eng.) - Electrical Engineering (109 credits)

The program gives students a broad understanding of the key principles that are responsible for the e

AND 3 credits selected from the approved list of courses in Humanities and Social Sciences, Management Studies and Law, listed below under Complementary Studies (Group B).

*Students may take MATH 139 (Calculus) instead of MATH 140, but only with permission from the Department of Mathematics and Statistics.

Required Non-Departmental Courses

32 credits

CCOM 206	(3)	Communication in Engineering
CIVE 281	(3)	Analytical Mechanics
COMP 202	(3)	Introduction to Computing 1
FACC 100	(1)	Introduction to the Engineering Profession
FACC 400	(1)	Engineering Professional Practice
MATH 262	(3)	Intermediate Calculus
MATH 263	(3)	Ordinary Differential Equations for Engineers
MATH 264	(3)	Advanced Calculus for Engineers
MATH 270	(3)	Applied Linear Algebra
MATH 381	(3)	Complex Variables and Transforms
MIME 310	(3)	Engineering Economy
PHYS 271	(3)	Introduction to Quantum Physics

Required Electrical Engineering Courses

57 credits

ECSE 200	(3)	Electric Circuits 1
ECSE 210	(3)	Electric Circuits 2
ECSE 211	(3)	Design Principles and Methods
ECSE 212*	(3)	Properties of Materials in Electrical Engineering
ECSE 221	(3)	Introduction to Computer Engineering
ECSE 291	(2)	Electrical Measurements Laboratory
ECSE 303	(3)	Signals and Systems 1
ECSE 304	(3)	Signals and Systems 2

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Complementary Courses

20-21 credits

Technical Complementaries

12 credits from the following:

ECSE 404	(3)	Control Systems
ECSE 405	(3)	Antennas

ECSE 486	(2)	Power Laboratory
ECSE 487	(2)	Computer Architecture Laboratory
ECSE 488	(2)	High Frequency Laboratory

OR one of the following:

ARCH 350	(3)	The Material Culture of Canada
BUSA 465*	(3)	Technological Entrepreneurship
ENVR 203	(3)	Knowledge, Ethics and Environment
ENVR 400	(3)	Environmental Thought
FACC 220	(3)	Law for Architects and Engineers
FACC 500	(3)	Technology Business Plan Design
FACC 501	(3)	Technology Business Plan Project
INDR 294*	(3)	Introduction to Labour-Management Relations
MATH 338	(3)	History and Philosophy of Mathematics
MGCR 222*	(3)	Introduction to Organizational Behaviour
MGCR 352*	(3)	Marketing Management 1
MRKT 360*	(3)	Marketing of Technology
ORGB 321*	(3)	Leadership
ORGB 423*	(3)	Human Resources Management

*Note: Management courses have limited enrolment and re

Required Courses

9 credits

ECSE 462	(3)	Electromecha
ECSE 464	(3)	Power System
ECSE 465	(3)	Power Electro

Students must also complete ECSE 474 and 475 (Electrical Engineering Design Projects 1 and 2) on a practical project in power engineering, preferably at the Institute or with a company sponsoring the Institute.

Complementary Courses

6 credits from the following:

ECSE 404	(3)	Control Syste
ECSE 460*	(3)	Appareillage
ECSE 467*	(3)	Comporteme
ECSE 468*	(3)	Electricité in ower Systems)
ECSE 469*	(3)	Protection de des

* courses taught in French.

Note: ECSE 460, ECSE 464 (Fall semester), ECSE 465, ECS and ECSE 469 are courses sponsored by the Institute and taught at École Polytechnique de Montréal.

11.5.5 Bachelor of Engineering (B.Eng.) - Honours E

This program is designed for students who wish to pursue po complementaries are selected from graduate courses, facilita classes and have more contact with professorial staff and gra

Total program credit weight: 109-110 credits.

Entry into the Electrical Engineering Honours Pro

The Honours program is a limited enrolment program and entry is highly competitive. There is no direct entry to the Honours program in the first year. Students may enter the Honours program in the following ways:

- Students from CEGEP will be admitted, on the basis of their grades, at the start of the third term.

PHYS 131	(4)	Mechanics and Waves
PHYS 142	(4)	Electromagnetism and Optics

AND 3 credits selected from the approved list of courses in Humanities and Social Sciences, Management Studies and Law, listed below under Complementary Studies (Group B).

*Students may take MATH 139 (Calculus) instead of MATH 140, but only with permission from the Department of Mathematics and Statistics.

Required Non-Departmental Courses

32 credits

CCOM 206	(3)	Communication in Engineering
CIVE 281*	(3)	Analytical Mechanics
COMP 202	(3)	Introduction to Computing 1
FACC 100	(1)	Introduction to the Engineering Profession
FACC 400	(1)	Engineering Professional Practice
MATH 262	(3)	Intermediate Calculus
MATH 263*	(3)	Ordinary Differential Equations for Engineers
MATH 264	(3)	Advanced Calculus for Engineers
MATH 271*	(3)	Linear Algebra and Partial Differential Equations
MATH 381*	(3)	Complex Variables and Transforms
MIME 310	(3)	Engineering Economy
PHYS 271	(3)	Introduction to Quantum Physics

*Though not required to do so, students in the Honours program or wishing to enter the Honours program are encouraged to take the following advanced math and physics courses instead of the required courses marked by (*):

MATH 247 (Honours Applied Linear Algebra) instead of MATH 271

MATH 249 (Honours Complex Variables) instead of MATH 381

MATH 325 (Honours Ordinary Differential Equations) instead of MATH 263

PHYS 251 (Honours Classical Mechanics) instead of CIVE 281

Required Electrical Engineering Courses

60 credits

ECSE 200	(3)	Electric Circuits 1
ECSE 210	(3)	Electric Circuits 2
ECSE 211	(3)	Design Principles and Methods
ECSE 212*	(3)	Properties of Materials in Electrical Engineering
ECSE 221	(3)	Introduction to Computer Engineering
ECSE 291	(2)	Electrical Measurements Laboratory
ECSE 303	(3)	Signals and Systems 1
ECSE 304	(3)	Signals and Systems 2
ECSE 305	(3)	Probability and Random Sig. 1
ECSE 322	(3)	Computer Engineering
ECSE 323	(5)	Digital System Design
ECSE 330	(3)	Introduction to Electronics
ECSE 334	(3)	Introduction to Microelectronics
ECSE 351	(3)	Electromagnetic Fields
ECSE 352	(3)	Electromagnetic Waves

ECSE 361	(3)	Power Engineering
ECSE 434	(2)	Microelectronics Laboratory
ECSE 498	(3)	Honours Thesis 1
ECSE 499	(3)	Honours Thesis 2
ECSE 543	(3)	Numerical Methods in Electrical Engineering
MIME 262*	(3)	Properties of Materials in Electrical Engineering

*Students select either ECSE 212 or MIME 262 from the list above.

Complementary Courses

17-18 credits

11-12 credits from List A and List B

List 2 credits from List

ECON 225	(3)	Economics of the Environment
ECON 347	(3)	Economics of Climate Change
ENVR 201	(3)	Society and Environment
GEOG 200	(3)	Geographical Perspectives: World Environmental Problems
GEOG 203	(3)	Environmental Systems
GEOG 205	(3)	Global Change: Past, Present and Future
GEOG 302	(3)	Environmental Management 1
MECH 526	(3)	Manufacturing and the Environment
MGPO 440	(3)	Strategies for Sustainability
MIME 308	(3)	Social Impact of Technology
PHIL 343	(3)	Biomedical Ethics
RELG 270	(3)	Religious Ethics and the Environment
SOCI 235	(3)	Technology and Society
SOCI 312	(3)	Sociology of Work and Industry
URBP 201	(3)	Planning the 21st Century City

Group B - Humanities and Social Sciences, Management Studies and Law

3 credits at the 200-level or higher from the following departments:

Anthropology (ANTH)

Economics (any 200- or 300-level course excluding ECON 208, ECON 217, ECON 227 and ECON 337)

LIST B

6 credits from the following:

COMP 424	(3)	Artificial Intelligence
ECSE 404	(3)	Control Systems
ECSE 411	(3)	Communications Systems 1
ECSE 412	(3)	Discrete Time Signal Processing
ECSE 420	(3)	Parallel Computing
ECSE 421	(3)	Embedded Systems
ECSE 422	(3)	Fault Tolerant Computing
ECSE 429	(3)	Software Validation
ECSE 436	(3)	Signal Processing Hardware
ECSE 443	(3)	Introduction to Numerical Methods in Electrical Engineering
ECSE 450	(3)	Electromagnetic Compatibility
ECSE 530	(3)	Logic Synthesis
ECSE 532	(3)	Computer Graphics
ECSE 548	(3)	Introduction to VLSI Systems

Laboratory Complementaries

2-3 credits

Note: The lab course is intended to strengthen the practical knowledge within one of the body of knowledge core units and as such should complement one of the core unit lecture courses, namely ECSE 334, ECSE 414, or ECSE 425.

ECSE 434	(2)	Microelectronics Laboratory
ECSE 436	(3)	Signal Processing Hardware
ECSE 487	(2)	Computer Architecture Laboratory
ECSE 489	(2)	Telecommunication Network Laboratory
ECSE 490	(2)	Digital Signal Processing Laboratory
ECSE 491	(2)	Communication Systems Laboratory
ECSE 493	(2)	Control and Robotics Laboratory

Complementary Studies

6 credits from Group A and Group B

Group A - Impact of Technology on Society

3 credits from the following:

ANTH 212	(3)	Anthropology of Development
BTEC 502	(3)	Biotechnology Ethics and Society
CHEE 430	(3)	Technology Impact Assessment
CIVE 469	(3)	Infrastructure and Society
ECON 225	(3)	Economics of the Environment
ECON 347	(3)	Economics of Climate Change
ENVR 201	(3)	Society and Environment
GEOG 200	(3)	Geographical Perspectives: World Environmental Problems
GEOG 203	(3)	Environmental Systems

GEOG 205	(3)	Global Change: Past, Present and Future
GEOG 302	(3)	Environmental Management 1
MECH 526	(3)	Manufacturing and the Environment
MGPO 440	(3)	Strategies for Sustainability
MIME 308	(3)	Social Impact of Technology
PHIL 343	(3)	Biomedical Ethics
RELG 270	(3)	Religious Ethics and the Environment
SOCI 235	(3)	Technology and Society
SOCI 312	(3)	Sociology of Work and Industry
URBP 201	(3)	Planning the 21st Century City

Group B - Humanities and Social Sciences, Management Studies and Law

3 credits at the 200-level or higher from the following departments:

FACC 400	(1)	Engineering Professional Practice
MATH 262	(3)	Intermediate Calculus
MATH 263	(3)	Ordinary Differential Equations for Engineers
MATH 264	(3)	Advanced Calculus for Engineers
MATH 270	(3)	Applied Linear Algebra
MATH 363	(3)	Discrete Mathematics

Engineering Breadth Required Courses

23 credits

CCOM 206	(3)	Communication in Engineering
ECSE 200	(3)	Electric Circuits 1
ECSE 210	(3)	Electric Circuits 2
ECSE 291	(2)	Electrical Measurements Laboratory
ECSE 305	(3)	Probability and Random Sig. 1
ECSE 306	(3)	Fundamentals of Signals and Systems
ECSE 330	(3)	Introduction to Electronics
MIME 310	(3)	Engineering Economy

Complementary Courses

18-26 credits

Basic Science Complementary Courses (for CEGEP students only)

0-6 credits

Students from CEGEP are required to complete two 3-credit courses at the 200-level or higher, chosen from the following science departments, approved by the Undergraduate Programs Office in the Department of Electrical and Computer Engineering:

Atmospheric and Oceanic Sciences (ATOC)

Biology (BIOL)

Chemistry (CHEM)

Earth and Planetary Sciences (EPSC)

Earth System Science (ESYS)

Physics (PHYS)

Technical Complementaries

12-15 credits

Not all courses listed are offered in a given year. See the course listing at http://www.mcgill.ca/students/courses/calendars/search to know when a course is offered.

List A

6-7 credits from the following:

COMP 330	(3)	Theoretical Aspects: Computer Science
COMP 350	(3)	Numerical Computing
COMP 409	(3)	Concurrent Programming
COMP 424	(3)	Artificial Intelligence
COMP 520	(4)	Compiler Design
COMP 566	(3)	Discrete Optimization 1
COMP 575	(3)	Fundamentals of Distributed Algorithms

ECSE 529	(3)	Computer and Biological Vision

List B

6-8 credits from the following:

COMP 535*	(3)	Computer Networks 1
COMP 557**	(3)	Fundamentals of Computer Graphics
ECSE 323	(5)	Digital System Design
ECSE 404	(3)	Control Systems
ECSE 411	(3)	Communications Systems 1
ECSE 412	(3)	Discrete Time Signal Processing
ECSE 413	(3)	Communications Systems 2
ECSE 414*	(3)	Introduction to Telecommunication Networks
ECSE 421	(3)	Embedded Systems
ECSE 422	(3)	Fault Tolerant Computing
ECSE 424	(3)	Human-Computer Interaction
ECSE 425	(3)	Computer Organization and Architecture
ECSE 426	(3)	Microprocessor Systems
ECSE 504	(3)	Sampled Data Control
ECSE 530	(3)	Logic Synthesis
ECSE 532**	(3)	Computer Graphics

*Students choose either COMP 535 or ECSE 414.

**Students choose either COMP 557 or ECSE 532.

Complementary Studies

6 credits

3 credits selected from the Impact of Technology on Society course list below.

3 credits selected from the Humanities and Social Sciences, Management Studies and Law course lists below.

Note: Out-of-province (high school) students completing the basic science requirements for students entering outside Quebec need an additional 3 credits of pre-engineering Humanities and Social Sciences (HSS) courses. Please contact the Faculty of Engineering for information.

Group A - Impact of Technology on Society

3 credits from the following:

ANTH 212	(3)	Anthropology of Development
BTEC 502	(3)	Biotechnology Ethics and Society
CHEE 430	(3)	Technology Impact Assessment
CIVE 469	(3)	Infrastructure and Society
ECON 225	(3)	Economics of the Environment
ECON 347	(3)	Economics of Climate Change
ENVR 201	(3)	Society and Environment
GEOG 200	(3)	Geographical Perspectives: World Environmental Problems
GEOG 203	(3)	Environmental Systems
GEOG 205	(3)	Global Change: Past, Present and Future
GEOG 302	(3)	Environmental Management 1
MECH 526	(3)	Manufacturing and the Environment

MGPO 440	(3)	Strategies for Sustainability
MIME 308	(3)	Social Impact of Technology
PHIL 343	(3)	Biomedical Ethics
RELG 270	(3)	Religious Ethics and the Environment
SOCI 235	(3)	Technology and Society
SOCI 312	(3)	Sociology of Work and Industry
URBP 201	(3)	Planning the 21st Century City

Group B - Humanities and Social Sciences, Management Studies and Law

3 courses at the 200-level or higher from the following departments:

Anthropology (ANTH)

Economics (any 200- or 300-level course excluding ECON 208, ECON 217, ECON 227 and ECON 337)

History (HIST)

Philosophy (excluding PHIL 210 and PHIL 310)

Political Science (POLI)

Psychology (excluding PSYC 204 and PSYC 305, but including PSYC 100)

Religious Studies (RELG)

School of Social Work (SWRK)

Sociology (excluding SOCI 350)

OR one of the following:

ARCH 350	(3)	The Material Culture of Canada
BUSA 465*	(3)	Technological Entrepreneurship
ENVR 203	(3)	Knowledge, Ethics and Environment
ENVR 400	(3)	Environmental Thought
FACC 220	(3)	Law for Architects and Engineers
FACC 500	(3)	Technology Business Plan Design
FACC 501	(3)	Technology Business Plan Project
INDR 294*	(3)	Introduction to Labour-Management Relations
MATH 338	(3)	History and Philosophy of Mathematics
MGCR 222*	(3)	Introduction to Organizational Behaviour
MGCR 352*	(3)	Marketing Management 1
MRKT 360*	(3)	Marketing of Technology
ORGB 321*	(3)	Leadership
ORGB 423*	(3)	Human Resources Management

*Note: Management courses have limited enrolment and registration dates. See Important Dates at http://www.mcgill.ca/importantdates.

Language Courses

If you are not proficient in a certain language, 3 credits will be given for one 6-credit course in that language.

However, 3 credits may be given for any language course that has a sufficient cultural component. You must have this course approved by a faculty adviser.

11.6 Department of Mechanical Engineering

11.6.1 Location

Macdonald Engineering Building, Room 270
817 Sherbrooke Street West
Montreal, Quebec H3A 2K6

Telephone: 514-398-6296
Fax: 514-398-7365
Website: *www.mcgill.ca/mecheng*

11.6.2 About the Department of Mechanical Engineering

Mechanical engineers are traditionally concerned with the conception, design, implementation and operation of mechanical systems. Typical fields of work are aerospace, energy, manufacturing, machinery, and transportation. Because of the very broad nature of the discipline there is usually a high demand for mechanical engineers.

Many mechanical engineers follow other career paths. Graduate studies are useful for the specialists working in research establishments, consulting firms, or in corporate research and development.

To prepare the mechanical engineer for a wide range of career possibilities, there is a heavy emphasis in our curriculum on the fundamental analytical disciplines. This is balanced by a sequence of experimental and design engineering courses which include practice in design, manufacturing and experimentation. In these courses students learn how to apply their analytical groundwork to the solution of practical problems.

Concentrations in Aeronautical Engineering, Mechatronics, and Design are available for students in either the regular or honours program who wish to specialize in these areas.

While the program is demanding, there is time for many extracurricular activities. Students are active in such professional societies as CASI (Canadian Aeronautics and Space Institute), SAE (Society of Automotive Engineers), and ASME (American Society of Mechanical Engineers) and in various campus organizations.

Relations between faculty and students are extremely close. Social functions, at which students and professors meet to exchange views and get to know each other better, are organized frequently.

11.6.3 Department of Mechanical Engineering Faculty

Chair

George Haller

Emeritus Professors

Abdul M. Ahmed; B.Sc.(Dhaka), M.Eng., Ph.D.(McG.), Eng. (*Thomas Workman Emeritus Professor of Mechanical Engineering*)

Romuald Knystautas; B.Eng., M.Eng., Ph.D.(McG.), Eng.

Michael P. Pa doussis; B.Eng.(McG.), Ph.D.(Camb.), Eng., F.I.Mech.E., F.A.S.M.E., F.A.A.M., F.C.S.M.E., F.R.S.C., F.C.A.E. (*Thomas Workman Emeritus Professor of Mechanical Engineering*)

Stuart J. Price; B.Sc., Ph.D.(Brist.), P.Eng.

Post-Retirement

Lucjan Kops; B.Eng., M.Eng., D.Sc.Eng.(Krakow Tech.), Eng., F.C.I.R.P., F.A.S.M.E., F.C.S.M.E., M.S.M.E.

Professors

Marco Amabili; B.Eng.(Ancona), Ph.D.(Bologna) (*Tier 1 Canada Research Chair*)

Jorge Angeles; B.Eng., M.Eng.(UNAM Mexico), Ph.D.(Stan.), Eng., F.A.S.M.E., F.C.S.M.E., F.R.S.C. (*James McGill Professor*)

Bantwal R. Baliga; B.Tech.(IIT, Kanpur), M.Sc.(Case West.), Ph.D.(Minn.)

Eliot Fried; A.B.(Calif., Berk.), M.S., Ph.D.(Cal. Tech.) (*Tier 1 Canada Research Chair*)

Wagdi G. Habashi; B.Eng., M.Eng.(McG.), Ph.D.(C'nell), P.Eng., F.C.A.E., F.A.S.M.E., F.R.S.C. (*NSERC-J. Armand Bombardier-Bell-Helicopter Industrial Research Chair in Multidisciplinary CFD*)

Professors

John H.S. Lee; B.Eng.(McG.), M.Sc.(MIT), Ph.D.(McG.), P.Eng. F.R.S.C.

George Haller; M.S.(Budapest Tech.), Ph.D.(Cal. Tech.) (*Faculty of Engineering Distinguished Professor*)

Dan Mateescu; M.Eng.(Univ-Poli. Bucharest), Ph.D.(Rom. Acad. Sci.), Doctor Honoris Causa(Univ-Poli.Bucharest), F.C.A.S.I., A.F.A.I.A.A., Erskine Fellow(Cant.)

Arun K. Misra; B.Tech.(IIT, Kharagpur), Ph.D.(Br. Col.), P.Eng., F.A.A.S., A.F.A.I.A.A. (*Thomas Workman Professor of Mechanical Engineering*)

Luc Mongeau; B.S.M.E., M.S.(École Poly., Montr.), Ph.D.(Penn. St.) (*Tier 1 Canada Research Chair*), *Associate Dean, Academic Affairs, Director, Graduate Admissions and Scholarships*

Christophe Pierre; B.Eng.(École Centrale, Paris), M.Sc.(Prin.), Ph.D.(Duke) (*Tier 1 Canada Research Chair*), *Dean, Faculty of Engineering*

Associate Professors

Luca Cortelezzi; M.Sc., Ph.D.(Cal. Tech.)

David L. Frost; B.A.Sc.(Br. Col.), M.S., Ph.D.(Cal. Tech.), P.Eng., *Graduate Program Director*

Andrew J. Higgins; B.Sc.(Ill.), M.S., Ph.D.(Wash.)

Pascal Hubert; B.Eng., M.Sc.(École Poly., Montr.), Ph.D.(Br. Col.), P.Eng. (*Canada Research Chair*), *Aerospace Program Coordinator*

Jozsef Kövecses; M.Sc.(U. Miskolc), Ph.D.(Hung. Acad. Sci.), P.Eng.

Tim Lee; M.S.(Port. St.), Ph.D.(Idaho)

Larry B. Lessard; B.Eng.(McG.), M.Sc., Ph.D.(Stan.), P.Eng., *Undergraduate Program Director, Honours Program Director*

R. Mongrain; B.Sc., M.Sc.(Montr.), Ph.D.(École Poly., Montr.), Eng. (*William Dawson Scholar*)

Laurent Mydlarski; B.A.Sc.(Wat.), Ph.D.(C'nell), Eng.

Siva Nadarajah; B.Sc.(Math), B.Sc.(Aero.Eng.)(Kansas), M.Sc., Ph.D.(Stan.)

Meyer Nahon; B.Sc.(Qu.), M.Sc.(Tor.), Ph.D.(McG.), P.Eng., *Associate Dean, Graduate and Postdoctoral Studies*

Peter Radziszewski; B.A.Sc.(Br. Col.), M.Sc., Ph.D.(Laval), Ing.

Inna Sharf; B.A.Sc., Ph.D.(Tor.), P.Eng.

Vince Thomson; B.Sc.(Windsor), Ph.D.(McM.) (*Werner Graupe Professor of Manufacturing Automation*)

Evgeny V

11.6.4 Bachelor of Engineering (B.Eng.) - Mechanical Engineering (112 credits)

To prepare the mechanical engineer for a wide range of career possibilities, there is a heavy emphasis in our curriculum on the fundamental analytical disciplines. This is balanced by a sequence of experimental and design engineering courses which include practice in design, manufacturing and experimentation. In these courses students learn how to apply their analytical groundwork to the solution of practical problems.

Special interests are satisfied by selecting appropriate complementary courses from among those offered with a specific subject concentration, such as management, industrial engineering, computer science, controls and robotics, bio-engineering, aeronautics, combustion, systems engineering, etc.

Required Year 0 (Freshman) Courses

30 credits

Generally, students admitted to Engineering from Quebec CEGEPs are granted transfer credit for these Year 0 (Freshman) courses (except FACC 100).

F

MECH 240	(3)	Thermodynamics 1
MECH 260	(2)	Machine Tool Laboratory
MECH 262	(3)	Statistics and Measurement Laboratory
MECH 289	(3)	Design Graphics
MECH 292	(3)	Conceptual Design
MECH 309	(3)	Numerical Methods in Mechanical Engineering
MECH 314	(3)	Dynamics of Mechanisms
MECH 315	(4)	Mechanics 3
MECH 321	(3)	Mechanics of Deformable Solids
MECH 331	(3)	Fluid Mechanics 1
MECH 341	(3)	Thermodynamics 2
MECH 346	(3)	Heat Transfer
MECH 362	(2)	Mechanical Laboratory 1
MECH 383	(3)	Applied Electronics and Instrumentation
MECH 393	(3)	Machine Element Design
MECH 412	(3)	Dynamics of Systems
MECH 430	(3)	Fluid Mechanics 2
	(3)	Mechanical Engineering Project

3 credits chosen from courses at the 300-level or higher in the Faculty of Engineering (including MECH courses) or from courses in the Faculty of Science, including MATH courses, approved by the Department.

FACC 500	(3)	Technology Business Plan Design
FACC 501	(3)	Technology Business Plan Project
INDR 294*	(3)	Introduction to Labour-Management Relations
MATH 338	(3)	History and Philosophy of Mathematics
MGCR 222*	(3)	Introduction to Organizational Behaviour
MGCR 352*	(3)	Marketing Management 1
MRKT 360*	(3)	Marketing of Technology
ORGB 321*	(3)	Leadership
ORGB 423*	(3)	Human Resources Management

*Note: Management courses have limited enrolment and registration dates. See Important Dates at http://www.mcgill.ca/importantdates.

Language Courses

If you are not proficient in a certain language, 3 credits will be given for one 6-credit course in that language.

However, 3 credits may be given for any language course that has a sufficient cultural component. You must have this course approved by a faculty adviser.

Typical Program of Study

Students entering the program from CEGEP follow a different curriculum than those entering from out of province. Students will be advised by the Department as to which courses they should select from the course lists above.

For a detailed curriculum, please see http://www.mcgill.ca/mecheng/undergrad/curriculum.

For all minors and concentrations, students should complete a Course Authorization Form, available from the Student Affairs Office (Engineering Student Center) or from the Undergraduate Program Secretary, indicating their intention to take the minor or the concentration.

11.6.5 Bachelor of Engineering (B.Eng.) - Honours Mechanical Engineering (112 credits)

To prepare the mechanical engineer for a wide range of career possibilities, there is a heavy emphasis in our curriculum on the fundamental analytical disciplines. This is balanced by a sequence of experimental and design engineering courses which include practice in design, manufacturing and experimentation. In these courses students learn how to apply their analytical groundwork to the solution of practical problems.

The Honours program is particularly suitable for those with a high aptitude in mathematics and physics and gives a thorough grounding in the basic engineering sciences.

Special interests are satisfied by selecting appropriate complementary courses from among those of Tml include practd8.1 Tf

Required Non-Departmental Courses

27 credits

CCOM 206	(3)	Communication in Engineering
CIVE 207	(4)	Solid Mechanics
COMP 208	(3)	Computers in Engineering
FA	(1)	Introduction to the Engineering Profession

MATH 381	(3)	Complex Variables and Transforms
MATH 417	(3)	Mathematical Programming

6 credits from the following:

MECH 546	(3)	Finite Element Methods in Solid Mechanics
MECH 562	(3)	Advanced Fluid Mechanics
MECH 578	(3)	Advanced Thermodynamics

6 credits at the 300-level or higher, chosen from Mechanical Engineering courses (subject code MECH). One of these two courses (3 credits) must be from the following list:

CHEE 563*	(3)	Biofluids and Cardiovascular Mechanics
MECH 497	(3)	Value Engineering
MECH 498	(3)	Interdisciplinary Design Project 1
MECH 499	(3)	Interdisciplinary Design Project 2
MECH 513	(3)	Control Systems
MECH 524	(3)	Computer Integrated Manufacturing
MECH 526	(3)	Manufacturing and the Environment
MECH 528	(3)	Product Design
MECH 541	(3)	Kinematic Synthesis
MECH 543	(3)	Design with Composite Materials
MECH 553	(3)	Design and Manufacture of Microdevices
MECH 554	(3)	Microprocessors for Mechanical Systems
MECH 557	(3)	Mechatronic Design
MECH 563*	(3)	Biofluids and Cardiovascular Mechanics
MECH 565	(3)	Fluid Flow and Heat Transfer Equipment
MECH 573	(3)	Mechanics of Robotic Systems
MECH 577	(3)	Optimum Design
MECH 593	(3)	Design Theory and Methodology

*Students choose either CHEE 563 or MECH 563.

3 credits chosen from courses at the 300-level or higher in the Faculty of Engineering (including MECH courses) or MIME 360 or from courses in the Faculty of Science, including MATH courses, approved by the Department.

Complementary Studies

6 credits

Group A - Impact of Technology on Society

3 credits from the following:

ANTH 212	(3)	Anthropology of Development
BTEC 502	(3)	Biotechnology Ethics and Society
CHEE 430	(3)	Technology Impact Assessment
CIVE 469	(3)	Infrastructure and Society
ECON 225	(3)	Economics of the Environment
ECON 347	(3)	Economics of Climate Change

ENVR 201	(3)	Society and Environment
GEOG 200	(3)	Geographical Perspectives: World Environmental Problems
GEOG 203	(3)	Environmental Systems
GEOG 205	(3)	Global Change: Past, Present and Future
GEOG 302	(3)	Environmental Management 1
		Manufacturing and the En

However, 3 credits may be given for any language course that has a sufficient cultural component. You must have this course approved by a faculty adviser.

Typical Program of Study

Students entering the program from CEGEP follow a different curriculum than those entering from out of province. Students will be advised by the Department as to which courses they should select from the course lists above.

For a detailed curriculum, see http://www.mcgill.ca/mecheng/undergrad/curriculum.

For all minors and concentrations, students should complete a Course Authorization Form, available from the Student Affairs Office (Engineering Student Center) or from the Undergraduate Program Secretary, indicating their intention to take the minor or concentration.

11.6.6 Bachelor of Engineering (B.Eng.) - Mechanical Engineering - Aeronautical Engineering (15 credits)

Students in this concentration take five courses in the area of Aeronautical Engineering. All courses must be passed with a grade of C or better.

Students should discuss their course selection with their adviser and complete a Course Authorization Form, available from the Student Affairs Office (Engineering Student Center) or from the Undergraduate Program Secretary, indicating their intention to take the concentration.

Required Courses

6 credits

MECH 532	(3)	Aircraft Performance, Stability and Control
MECH 533	(3)	Subsonic Aerodynamics

Complementary Courses

9 credits chosen from the lists below

3-6 credits from the following:

MECH 535	(3)	Turbomachinery and Propulsion
MECH 536	(3)	Aircraft Structures

3-6 credits from the following:

MECH 531	(3)	Aeroelasticity
MECH 537	(3)	High-Speed Aerodynamics
MECH 538	(3)	Unsteady Aerodynamics
MECH 539	(3)	Computational Aerodynamics
MECH 565	(3)	Fluid Flow and Heat Transfer Equipment

11.6.7 Bachelor of Engineering (B.Eng.) - Honours Mechanical Engineering - Aeronautical Engineering (15 credits)

Students in this concentration take five courses in the area of Aeronautical Engineering. All courses must be passed with a grade of C or better.

Students should discuss their course selection with their adviser and complete a Course Authorization Form, available from the Student Affairs Office (Engineering Student Center) or from the Undergraduate Program Secretary, indicating their intention to take the concentration.

Required Courses

6 credits

MECH 532	(3)	Aircraft Performance, Stability and Control
MECH 533	(3)	Subsonic Aerodynamics

Complementary Courses

9 credits chosen from the lists below

3-6 credits from the following:

MECH 535	(3)	Turbomachinery and Propulsion
MECH 536	(3)	Aircraft Structures

3-6 credits from the following:

MECH 531	(3)	Aeroelasticity
MECH 537	(3)	High-Speed Aerodynamics
MECH 538	(3)	Unsteady Aerodynamics
MECH 539	(3)	Computational Aerodynamics
MECH 565	(3)	Fluid Flow and Heat Transfer Equipment

11.6.8 Bachelor of Engineering (B.Eng.) - Mechanical Engineering - Design (15 credits)

Students in this concentration take five courses in the area of design, including the completion of an interdisciplinary project.

Students should complete a Course Authorization Form, available from the Student Affairs Office (Engineering Student Center) or from the Undergraduate Program Secretary, indicating their intention to take the concentration.

Total concentration credit weight: 15-16 credits.

Required Courses

6 credits

MECH 498	(3)	Interdisciplinary Design Project 1
MECH 499	(3)	Interdisciplinary Design Project 2

Complementary Courses

9-10 credits from the following:

ARCH 515	(3)	Sustainable Design
CHEE 453	(4)	Process Design
MECH 497	(3)	Value Engineering
MECH 526	(3)	Manufacturing and the Environment
MECH 528	(3)	Product Design
MECH 530	(3)	Mechanics of Composite Materials
MECH 541	(3)	Kinematic Synthesis
MECH 543	(3)	Design with Composite Materials
MECH 554	(3)	Microprocessors for Mechanical Systems
MECH 557	(3)	Mechatronic Design
MECH 565	(3)	Fluid Flow and Heat Transfer Equipment
MECH 576	(3)	Geometry in Mechanics
MECH 577	(3)	Optimum Design
MECH 579	(3)	Multidisciplinary Design Optimization
MECH 593	(3)	Design Theory and Methodology

11.6.9 Bachelor of Engineering (B.Eng.) - Honours Mechanical Engineering - Design (15 credits)

Students in this concentration take five courses in the area of design, including the completion of an interdisciplinary project.

Students should complete a Course Authorization Form, available from the Student Affairs Office (Engineering Student Center) or from the Undergraduate Program Secretary, indicating their intention to take the concentration.

Total concentration credit weight: 15-16 credits.

Required Courses

6 credits

MECH 498	(3)	Interdisciplinary Design Project 1
MECH 499	(3)	Interdisciplinary Design Project 2

Complementary Courses

9-10 credits from the following:

ARCH 515	(3)	Sustainable Design
CHEE 453	(4)	Process Design
MECH 497	(3)	Value Engineering
MECH 526	(3)	Manufacturing and the Environment
MECH 528	(3)	Product Design
MECH 530	(3)	Mechanics of Composite Materials
MECH 541	(3)	Kinematic Synthesis
MECH 543	(3)	Design with Composite Materials
MECH 554	(3)	Microprocessors for Mechanical Systems
MECH 557	(3)	Mechatronic Design
MECH 565	(3)	Fluid Flow and Heat Transfer Equipment
MECH 576	(3)	Geometry in Mechanics
MECH 577	(3)	Optimum Design
MECH 579	(3)	Multidisciplinary Design Optimization
MECH 593	(3)	Design Theory and Methodology

11.6.10 Bachelor of Engineering (B.Eng.) - Mechanical Engineering - Mechatronics (18 credits)

Students in this concentration take six courses in the area of control, robotics and/or CAD/CAM.

Students should complete a Course Authorization Form, available from the Student Affairs Office (Engineering Student Center) or from the Undergraduate Program Secretary, indicating their intention to take the concentration.

Required Courses

12 credits

MECH 513	(3)	Control Systems
MECH 554	(3)	Microprocessors for Mechanical Systems
MECH 557	(3)	Mechatronic Design
MECH 572	(3)	Introduction to Robotics

Complementary Courses

6 credits from the following:

MECH 528	(3)	Product Design
MECH 541	(3)	Kinematic Synthesis
MECH 573	(3)	Mechanics of Robotic Systems
MECH 576	(3)	Geometry in Mechanics

11.6.11 Bachelor of Engineering (B.Eng.) - Honours Mechanical Engineering - Mechatronics (18 credits)

Students in this concentration take six courses in the area of control, robotics and/or CAD/CAM.

Students should complete a Course Authorization Form, available from the Student Affairs Office (Engineering Student Center) or from the Undergraduate Program Secretary, indicating their intention to take the concentration.

Required Courses

12 credits

MECH 513	(3)	Control Systems
MECH 554	(3)	Microprocessors for Mechanical Systems
MECH 557	(3)	Mechatronic Design
MECH 572	(3)	Introduction to Robotics

Complementary Courses

6 credits from the following:

MECH 528	(3)	Product Design
MECH 541	(3)	Kinematic Synthesis
MECH 573	(3)	Mechanics of Robotic Systems
MECH 576	(3)	Geometry in Mechanics

11.7 Department of Mining and Materials Engineering

11.7.1 Location

General Office:
Wong Building, Room 2140
3610 University Street
Montreal, Quebec H3A 2B2

Website: *www.mcgill.ca/minmat*

Materials

Wong Building, Room 2140
3610 University Street
Montreal, Quebec H3A 2B2
Telephone: 514-398-1040
Fax: 514-398-4492
Email: *coordinator.minmat@mcgill.ca*

Mining

Frank Dawson Adams Building, Room 125
3450 University Street
Montreal, Quebec H3A 2A7
Telephone: 514-398-2215
Fax: 514-398-7099
Email: *admin.mining@mcgill.ca*

11.7.2 About the Department of Mining and Materials Engineering

The Department of Mining and Materials Engineering offers programs leading to the Bachelor of Engineering degree in Materials Engineering or Mining Engineering. In addition to regular courses and laboratories, the curriculum includes seminars, colloquia and student projects reinforced by field trips to industrial operations.

For more information, refer to:

section 11.7.3.1: Mining Engineering (CO-OP)
section 11.7.3.2: Materials Engineering (CO-OP)

11.7.2.1 Scholarships

The Department offers renewable Entrance Scholarships every year. A substantial number of other scholarships and bursaries are also awarded by the Department as well as by the Canadian Mineral Industry Education Foundation.

11.7.3 Department of Mining and Materials Engineering Faculty

Chair

Stephen Yue

Associate Chair, Student Affairs

Frank Mucciardi

Associate Chair, Research

James A. Finch

Associate Chair, Graduate Studies

George P. Demopoulos

Emeritus Professors

John E. Gruzleski; B.Sc., M.Sc.(Qu.), Ph.D.(Tor.), Eng. (*Gerald G. Hatch Emeritus Professor*)

John J. Jonas; B.Eng.(McG.), Ph.D.(Camb.), Eng. (*Henry Birks Emeritus Professor*)

Gordon W. Smith; B.Eng., M.Eng., Ph.D.(McG.), Eng.

William M. Williams; B.Sc., M.Sc.(Brist.), Ph.D.(Tor.), Eng. (*Henry Birks Emeritus Professor*)

Post-Retirement

Michel L. Bilodeau; B.A.Sc.(Montr.), M.Sc.App., Ph.D.(McG.), Eng.

Professors

George P. Demopoulos; Dipl. Eng.(NTU Athens), M.Sc., Ph.D.(McG.), Eng.

Roussos Dimitrakopoulos; B.Sc., M.Sc.(Alta.), Ph.D.(École Poly., Montr.)

James A. Finch; B.Sc.(Birm.), M.Eng., Ph.D.(McG.), Eng. (*Gerald G. Hatch Professor*)

Raynald Gauvin; B.Ing., Ph.D.(Montr.), Eng.

Roderick I.L. Guthrie; B.Sc., Ph.D.(Lond.), D.I.C., A.R.S.M., Eng. (*William C. Macdonald Professor*)

Faramarz (Ferri) P. Hassani; Ph.D.(Nott.), (*George Boyd Webster Professor*)

Hani S. Mitri; B.Sc.(Cairo), M.Eng., Ph.D.(McM.), Eng.

Stephen Yue; B.Sc., Ph.D.(Leeds) (*James McGill Professor*)

Associate Professors

Mainul Hasan; B.Eng.(Dhaka), M.Sc.(Dhahran), Ph.D.(McG.)

Associate Professors

Frank Mucciardi; B.Eng., M.Eng., Ph.D.(McG.), Eng.

Mihriban Pekguleryuz; B.Eng., M.Eng.(Flor.), Ph.D.(McG.)

Assistant Professors

Mathieu Brochu; B.Eng.(Laval), Ph.D.(McG.)

Marta Cerruti; Ph.D., Laurea in Chem52 1 70,aoT1 0 0 1 214.07.2(MnfNTT4cG.)Sc..(Flor)TManch.D.(McG.)Birm0.9804 0.9216 0.8431 rg0.9804 0.9216 0.8431 RGE

11.7.3.1 About Materials Engineering

11.7.3.1.1 Materials Engineering (Co-op)

The Materials Engineering degree is a cooperative program leading to a B.Eng. and includes formal industrial work periods. It is built on a strong background of mathematics, basic sciences, computer skills and applications, and specific engineering and design courses to provide up-to-date training in materials engineering. Students tak

MIME 480	(2)	Industrial Training 3

*Students select either ECSE 461 or MIME 337.

Complementary Courses

18 credits

Technical Complementaries

12 credits of Technical Complementaries

9-12 credits from the following:

CIVE 512	(3)	Advanced Civil Engineering Materials
MECH 530	(3)	Mechanics of Composite Materials
MIME 410	(3)	Research Project
MIME 457	(3)	Light Metals Extraction and Processing
MIME 470	(3)	Engineering Biomaterials
MIME 512	(3)	Corrosion and Degradation of Materials
		Transmission Electron Microscopy

3 credits from the follo

MGCR 352*	(3)	Marketing Management 1
MGCR 360*	(3)	Social Context of Business
ORGB 321*	(3)	Leadership
ORGB 423*	(3)	Human Resources Management

*Management courses have limited enrolment and registration dates. See Important Dates at http://www.mcgill.ca/importantdates.

Language Courses

If you are not proficient in a certain language, 3 credits will be given for one 6-credit course in that language.

However, 3 credits may be given for any language course that has a sufficient cultural component. You must have this course approved by a faculty adviser.

11.7.5 Bachelor of Engineering (B.Eng.) - Mining Engineering CO-OP (120 credits)

In addition to regular courses and laboratories, the curriculum of the B.Eng. Mining Engineering Co-op program includes seminars, colloquia and student projects reinforced by field trips to industrial operations.

Students entering this program must plan their schedule of studies in consultation with a departmental adviser.

Total program credit weight: 120-122 credits.

Required Year 0 (Freshman) Courses

30 credits

Generally, students admitted to Engineering from Quebec CEGEPs are granted transfer credit for these Year 0 (Freshman) courses (except FACC 100).

For information on transfer credit for French Baccalaureate, International Baccalaureate exams, Advanced Placement exams, Advanced Levels and Science Placement Exams, see http://www.mcgill.ca/engineering/student/sao/newstudents and select your term of admission.

CHEM 110	(4)	General Chemistry 1
CHEM 120	(4)	General Chemistry 2
FACC 100	(1)	Introduction to the Engineering Profession
MATH 133	(3)	Linear Algebra and Geometry
MATH 140*	(3)	Calculus 1
MATH 141	(4)	Calculus 2
PHYS 131	(4)	Mechanics and Waves
PHYS 142	(4)	Electromagnetism and Optics

AND 3 credits selected from the approved list of courses in Humanities and Social Sciences, Management Studies and Law, listed below under Complementary Studies (Group B).

*Students may take MATH 139 (Calculus) instead of MATH 140, but only with permission from the Department of Mathematics and Statistics.

Required Non-Departmental Courses

31 credits

CCOM 206	(3)	Communication in Engineering
CIVE 205	(3)	Statics
CIVE 207	(4)	Solid Mechanics
COMP 208	(3)	Computers in Engineering
EPSC 221	(3)	General Geology
EPSC 225	(1)	Properties of Minerals
FACC 100	(1)	Introduction to the Engineering Profession
FACC 400	(1)	Engineering Professional Practice
MATH 262	(3)	Intermediate Calculus
MATH 263	(3)	Ordinary Differential Equations for Engineers

MATH 264	(3)	Advanced Calculus for Engineers
MECH 289	(3)	Design Graphics

Required Mining Engineering Courses

72-73 credits

ECSE 461*	(3)	Electric Machinery
MIME 200	(3)	Introduction to the Minerals Industry
		Mine Surv

Stream B

6 credits

MIME 350	(3)	Extractive Metallurgical Engineering
MIME 544	(3)	Analysis: Mineral Processing Systems 1

and 6 credits from the Technical Complementaries list below

Technical Complementaries

Courses can be chosen from the following or from any other approved technical courses in Engineering, Management or Science.

Note: Not all courses are given annually; see the course listing or Class Schedule at http://www.mcgill.ca/students/courses/calendars to know when a course is offered.

MIME 320	(3)	Extraction of Energy Resources
MIME 442	(3)	Analysis, Modelling and Optimization in Mineral Processing
MIME 513	(3)	Mine Planning Optimization Under Uncertainty
MIME 520	(3)	Stability of Rock Slopes
MIME 521	(3)	Stability of Underground Openings
MIME 525	(3)	Stochastic Orebody Modelling
MIME 526	(3)	Mineral Economics
MIME 527	(3)	Selected Topics in Mineral Resource Engineering
MIME 528	(3)	Mining Automation
MIME 544	(3)	Analysis: Mineral Processing Systems 1
MIME 545	(3)	Analysis: Mineral Processing Systems 2
MPMC 320	(3)	CAO et informatique pour les mines
MPMC 327	(3)	Hydrogéologie appliquée

* Mining courses taken at École Polytechnique

Complementary Studies

6 credits

Group A - Impact of Technology on Society

3 credits from the following:

ANTH 212	(3)	Anthropology of Development
BTEC 502	(3)	Biotechnology Ethics and Society
CHEE 430	(3)	Technology Impact Assessment
CIVE 469	(3)	Infrastructure and Society
ECON 225	(3)	Economics of the Environment
ECON 347	(3)	Economics of Climate Change
ENVR 201	(3)	Society and Environment
GEOG 200	(3)	Geographical Perspectives: World Environmental Problems
GEOG 203	(3)	Environmental Systems
GEOG 205	(3)	Global Change: Past, Present and Future
GEOG 302	(3)	Environmental Management 1
MECH 526	(3)	Manufacturing and the Environment
MGPO 440	(3)	Strategies for Sustainability

MIME 308	(3)	Social Impact of Technology
PHIL 343	(3)	Biomedical Ethics
RELG 270	(3)	Religious Ethics and the Environment
SOCI 235	(3)	Technology and Society
SOCI 312	(3)	Sociology of Work and Industry

815 Sherbrooke Street West
Montreal, Quebec H3A 2K6

Telephone: 514-398-4075
Fax: 514-398-8376
Email: *admissions.planning@mcgill.ca*
Website: *www.mcgill.ca/urbanplanning*

11.8.2 About the School of Urban Planning

Modern urban planning dev

URBP 520	(3)	Globalization: Planning and Change
URBP 530	(3)	Urban Environmental Planning

11.8.4 School of Urban Planning Faculty

Director

David F. Brown

Emerita Professor

Jane Matthews-Glenn; B.A., LL.B.(Qu.), D. en droit(Stras.)

Associate Professors

Madhav G. Badami; B.Tech., M.S.(IIT, Madras), M.E.Des.(Calg.), Ph.D.(Br. Col.) (*joint appoint. with McGill School of Environment*)

Lisa Bornstein; B.Sc.(Calif., Berk.), M.R.P.(C'nell), Ph.D.(Calif., Berk.)

David F. Brown; B.A.(Bishop's), M.U.P.(McG.), Ph.D.(Sheff.)

Raphaël Fischler; B.Eng.(V. Tech. Eindhoven), M.S. Arch.S., M.C.P.(MIT), Ph.D.(Calif., Berk.)

Assistant Professors

Ahmed Elgeneidy; B.S., M.S.(Alexandria), Ph.D.(Port. St.)

Nik Luka; B.A.(Ryerson), M.Arch.(Laval), Ph.D.(Tor.) (*joint appoint. with Architecture*)

Instructors

Heather Braiden; B.E.S.(Wat.), M.L.Arch.(Tor.)

Marc-André Lechasseur; LL.B.(Sher.), LL.M.(Montr.)

Alain Trudeau; B.Sc.(UQAM), M.U.P.(McG.)

Adjunct Professors

David Farley; B.Arch.(McG.), M.Arch., M.C.P.(Harv.)

Mario Polèse; B.A.(CUNY), M.A., Ph.D.(Penn.)

Ray Tomalty; B.A., M.P.A..(Qu.), Ph.D.(Wat.)

Guest Lecturers

Daniel Hodder

Andrew Hoffmann

Paul Le Cavalier

Brenda Lee

Eric Peissel

Richard Sheamur

Larry Sherman

Alain Trudeau

Martin Wexler

Joshua Wolfe

11.9 Faculty of Engineering Related Programs

11.9.1 Bioresource Engineering

The Faculty of Engineering cooperates with the Faculty of Agricultural and Environmental Sciences in providing courses of instruction for a curriculum in agricultural and biosystems engineering to meet requirements for a professional degree awarded in the Faculty of Agricultural and Environmental Sciences. For details of the curriculum, see *Faculty of Agricultural and Environmental Sciences > : Bachelor of Engineering (Bioresource) (B.Eng.(Bioresource)) - Major Bioresource Engineering (113 credits)*.

Some of the courses offered by the Department of Bioresource Engineering (subject code BREE) may be of interest to students in the Faculty of Engineering.

The Department of Bioresource Engineering is located in the Faculty of Agricultural and Environmental Sciences on the Macdonald campus:

Department of Bioresource Engineering
Room MS1-027, Macdonald Stewart Building
21,111 Lakeshore Road
Ste. Anne de Bellevue, Quebec H9X 3V9
Tel: 514-398-7773
Fax: 514-398-8387

11.9.2 Department of Biomedical Engineering

Lyman Duff Medical Sciences Building
3775 University Street
Montreal, Quebec H3A 2B4
Telephone: 514-398-8278

Some of the courses offered by the Department of Biomedical Engineering (subject code BMDE) may be of interest to Engineering students, and may be approved as complementary courses. The Faculty of Engineering also offers a Minor in Biomedical Engineering; for more information, see *section 11.10.2: Biomedical Engineering Minor*.

11.10 Minor Programs

Minors are coherent sequences of courses tak

Minor Programs

section 11.10.10: Management Minors: Minor in Finance, Minor in Management, Minor in Marketing, and Minor in Operations Management

section 11.10.11: Materials Engineering

section 11.10.12: Mathematics

section 11.10.13: Mining Engineering

section 11.10.14: Physics

section 11.10.16: Software Engineering

section 11.10.15: Technological Entrepreneurship

11.10.1 Arts Minor

The Arts Minor is open to B.Sc.(Arch.), B.Eng. and B.S.E. students. In this minor, students choose courses from two areas of concentration in the Faculty of Arts, approved by a faculty adviser in the Student Affairs Office, Engineering Student Centre, or by the Senior Faculty Adviser in the Faculty of Arts. B.Eng. and B.S.E. students may count some of their Complementary Studies courses toward this Minor, as described in the Arts Minor.

11.10.1.1 Bachelor of Engineering (B.Eng.) - Minor Arts (24 credits)

B.Sc.(Arch.), B.Eng. and B.S.E. students may obtain the Arts Minor as part of their B.Eng., B.S.E or B.Sc.(Arch.) degree by satisfying the 24-credit requirement described below.

Students must select courses for this minor in consultation with an adviser in the Student Affairs Office, Engineering Student Centre, or Donald Sedgwick, Senior Faculty Adviser, Faculty of Arts.

All courses in the Minor must be passed with a grade of C or better.

Requirements

Students must complete 24 credits as follows:

a) At least two areas of concentration from within the Faculty of Arts must be chosen, with a minimum of 6 credits in any one area.

b) At least 12 credits must be at the 300-level or higher.

In general, B.Eng. and B.S.E. students may use courses from the Complementary Studies lists (Group A and Group B) in their program that are offered by the Faculty of Arts to satisfy some of these requirements. No more than 9 credits of these courses can be credited toward the Arts minor.

11.10.2 Biomedical Engineering Minor

Biomedical engineering can be defined as the application of engineering principles to medicine and the life sciences. Students in the Biomedical Engineering Minor take courses in life sciences (anatomy, biology, chemistry and physiology) and choose courses from area(s) within the field of biomedicine (artificial cells and organs; bioinformatics, genomics and proteomics; biomaterials, biosensors and nanotechnology; biomechanics and prosthetics; medical physics and imaging; and neural systems and biosignal processing).

11.10.2.1 Bachelor of Engineering (B.Eng.) - Minor Biomedical Engineering (21 credits)

Note: open to all students in the Faculty of Engineering (including B.S.E. students).

The Biomedical Engineering Minor allows access to courses in basic life sciences and is intended to expose students to the interdisciplinary tools used in biomedicine.

To complete this minor, students must obtain a grade of C or better in all approved courses and satisfy the requirements of both the major program and the minor.

Students considering this minor should contact Prof. R. Leask (Room 4120, Wong Building) or Prof. R. Mongrain (Room 369, Macdonald Engineering Building).

Total minor credit weight: 21-25 credits.

Complementary Introductory Courses in Life Sciences

3-7 credits

One or two courses from the following list (equivalents can be approved):

ANAT 212	(3)	Molecular Mechanisms of Cell Function
BIOC 212	(3)	Molecular Mechanisms of Cell Function

BIOL 200	(3)	Molecular Biology
BIOL 201	(3)	Cell Biology and Metabolism
CHEM 212	(4)	Introductory Organic Chemistry 1
PHGY 201	(3)	Human Physiology: Control Systems
PHGY 202	(3)	Human Physiology: Body Functions
PHGY 209	(3)	Mammalian Physiology 1
PHGY 210	(3)	Mammalian Physiology 2

Specialization Courses

12 credits from the following:

Students must select 6 credits from courses outside their department and at least one BMDE course. These BMDE courses are best taken near the end of the program, when prerequisites are satisfied.

Artificial Cells and Organs

BMDE 505	(3)	Cell and Tissue Engineering
PHGY 311	(3)	Channels, Synapses & Hormones
PHGY 312	(3)	Respiratory, Renal, & Cardiovascular Physiology
PHGY 313	(3)	Blood, Gastrointestinal, & Immune Systems Physiology
PHGY 517	(3)	Artificial Internal Organs
PHGY 518	(3)	Artificial Cells

Bioinformatics, Genomics and Proteomics

ANAT 365*	(3)	Cellular Trafficking
ANAT 458	(3)	Membranes and Cellular Signaling
BIOC 311	(3)	Metabolic Biochemistry
BIOC 312	(3)	Biochemistry of Macromolecules
BIOC 458*	(3)	Membranes and Cellular Signaling
BMDE 506	(3)	Molecular Biology Techniques
COMP 302	(3)	Programming Languages and Paradigms
COMP 360	(3)	Algorithm Design Techniques
COMP 421	(3)	Database Systems
COMP 424	(3)	Artificial Intelligence
COMP 462	(3)	Computational Biology Methods
COMP 526	(3)	Probabilistic Reasoning and AI

*Students select either ANAT 365 or BIOC 458.

Biomaterials, Biosensors and Nanotechnology

BMDE 504	(3)	Biomaterials and Bioperformance
BMDE 505	(3)	Cell and Tissue Engineering
CHEE 380	(3)	Materials Science
ECSE 424	(3)	Human-Computer Interaction
MECH 553	(3)	Design and Manufacture of Microdevices
MIME 360	(3)	Phase Transformations: Solids

MIME 362	(3)	Mechanical Properties
PHYS 534	(3)	Nanoscience and Nanotechnology

Biomechanics and Prosthetics

BMDE 503	(3)	Biomedical Instrumentation
CHEE 563*	(3)	Biofluids and Cardiovascular Mechanics
MECH 315	(4)	Mechanics 3
MECH 321	(3)	Mechanics of Deformable Solids
MECH 530	(3)	Mechanics of Composite Materials
MECH 561	(3)	Biomechanics of Musculoskeletal Systems
MECH 563*	(3)	Biofluids and Cardiovascular Mechanics
MIME 360	(3)	Phase Transformations: Solids
MIME 362	(3)	Mechanical Properties

*Students select either CHEE 563 or MECH 563.

Medical Physics and Imaging

BMDE 519	(3)	Biomedical Signals and Systems
COMP 302	(3)	Programming Languages and Paradigms
COMP 360	(3)	Algorithm Design Techniques
COMP 423	(3)	Data Compression
COMP 424	(3)	Artificial Intelligence
COMP 558	(3)	Fundamentals of Computer Vision
ECSE 303	(3)	Signals and Systems 1
ECSE 304	(3)	Signals and Systems 2
ECSE 412	(3)	Discrete Time Signal Processing
PHYS 557	(3)	Nuclear Physics

Neural Systems and Biosignal Processing

BMDE 501	(3)	Selected Topics in Biomedical Engineering
BMDE 502	(3)	BME Modelling and Identification
BMDE 503	(3)	Biomedical Instrumentation
BMDE 519	(3)	Biomedical Signals and Systems
ECSE 526	(3)	Artificial Intelligence
PHYS 413	(3)	Physical Basis of Physiology

Complementary Courses

0-6 credits

Up to 6 credits in the B.Eng., B.S.E. or B.Sc.(Arch.) program can also be credited to the Minor, with the permission of the departmental adviser and approval of the Minor adviser. In particular, courses at the 200-level or higher that are prerequisites for certain specialization courses would be eligible, with permission of the Minor adviser. By careful selection of complementary courses, the Minor can be satisfied with 9 additional credits in the undergraduate program or a maximum of 12 credits overlap with the degree program.

11.10.3 Biotechnology Minor

Biotechnology can be defined as the science of understanding, selecting and promoting useful organisms and specific gene products for therapeutic purposes. It requires a broad comprehension of biology and engineering and detailed knowledge of at least one basic subject such as molecular genetics, protein chemistry, microbiology, or chemical engineering.

The Minor in Biotechnology, offered by the Faculties of Engineering and of Science, emphasizes an area relevant to biotechnology that is complementary to the student's main program. It is designed specifically for Chemical Engineering students; other Engineering students interested in taking this Minor should

Biomedicine

ANAT 541	(3)	Cell and Molecular Biology of Aging
EXMD 504	(3)	Biology of Cancer
PATH 300	(3)	Human Disease

Chemistry

CHEM 382	(3)	Organic Chemistry: Natural Products
CHEM 502	(3)	Advanced Bio-Organic Chemistry
CHEM 552	(3)	Physical Organic Chemistry

General

MIME 310	(3)	Engineering Economy

Immunology

ANAT 261	(4)	Introduction to Dynamic Histology
BIOC 503	(3)	Immunochemistry
MIMM 314	(3)	Immunology
MIMM 414	(3)	Advanced Immunology
PHGY 513	(3)	Cellular Immunology

Management

Note: Engineering students may not use these courses to count toward a Management minor, nor toward the Complementary Studies requirement.

ECON 208	(3)	Microeconomic Analysis and Applications
MGCR 211	(3)	Introduction to Financial Accounting
MGCR 341	(3)	Finance 1
MGCR 352	(3)	Marketing Management 1
MGCR 472	(3)	Operations Management

Microbiology

MIMM 323	(3)	Microbial Physiology
MIMM 324	(3)	Fundamental Virology
MIMM 413	(3)	Parasitology
MIMM 465	(3)	Bacterial Pathogenesis
MIMM 466	(3)	Viral Pathogenesis

Molecular Biology (Biology)

BIOL 300	(3)	Molecular Biology of the Gene
BIOL 314	(3)	Molecular Biology of Oncogenes
BIOL 520	(3)	Gene Activity in Development
BIOL 524	(3)	Topics in Molecular Biology
BIOL 551	(3)	Molecular Biology: Cell Cycle

Molecular Biology (Biochemistry)

BIOC 311	(3)	Metabolic Biochemistry
BIOC 312	(3)	Biochemistry of Macromolecules
BIOC 450	(3)	Protein Structure and Function
BIOC 454	(3)	Nucleic Acids
BIOC 455	(3)	Neurochemistry

Physiology

EXMD 401	(3)	Physiology and Biochemistry Endocrine Systems
EXMD 502	(3)	Advanced Endocrinology 01
EXMD 503	(3)	Advanced Endocrinology 02
PHAR 562	(3)	General Pharmacology 1
PHAR 563	(3)	General Pharmacology 2
PHGY 517	(3)	Artificial Internal Organs
PHGY 518	(3)	Artificial Cells

Pollution

Note: Engineering students may not use these courses to count toward the Environmental Engineering Minor.

CIVE 225	(4)	Environmental Engineering
CIVE 430	(3)	Water Treatment and Pollution Control
CIVE 553	(3)	Stream Pollution and Control

11.10.4 Chemistry Minor

The Departments of Chemistry and Chemical Engineering offer this Chemistry Minor, of particular interest to Chemical Engineering students, and a Chemical Engineering Minor, of interest to Chemistry students (described under the *Faculty of Science > : Bachelor of Science (B.Sc.) - Minor Chemical Engineering (24 credits)*). Students taking the Chemistry Minor complete 10 credits of required courses in physical and organic chemistry, and choose an additional 15 credits of complementary courses from the areas of inorganic, analytical, organic and physical chemistry.

Please consult the program coordinators for more information: Professor David Cooper (Chemical Engineering) and Dr. Gonzalo Cosa (Chemistry).

11.10.4.1 Bachelor of Engineering (B.Eng.) - Minor Chemistry (25 credits)

Please consult the program coordinator, Dr. Gonzalo Cosa, for more information about this minor.

A passing grade for courses within the Minor is a C.

Required Courses

10 credits

CHEE 310*	(3)	Physical Chemistry for Engineers
CHEM 212	(4)	Introductory Organic Chemistry 1
CHEM 233*	(3)	Topics in Physical Chemistry
CHEM 234**	(3)	Topics in Organic Chemistry

*Students select either CHEM 233 or CHEE 310

** or CEGEP equivalent

Complementary Courses

15 credits from the following lists, two courses of which must be laboratory courses (* indicates lab).

Note that CHEM 212 is a prerequisite for most of the courses listed below, and CHEM 223 (Introductory Physical Chemistry 1) and CHEM 243 (Introductory Physical Chemistry 2) or their equivalents are prerequisites for the physical chemistry courses. If students take CHEM 222 (Introductory Organic Chemistry 2), which includes a lab, instead of CHEM 234, they will receive credit for one of the two required laboratory courses, but they must complete a total of 25 credits in chemistry for the Minor.

Inorganic Chemistry

CHEM 281	(3)	Inorganic Chemistry 1
CHEM 371*	(2)	Inorganic Chemistry Laboratory
CHEM 381	(3)	Inorganic Chemistry 2
CHEM 591	(3)	Bioinorganic Chemistry

Analytical Chemistry

CHEM 307	(3)	Analytical Chemistry of Pollutants
CHEM 367	(3)	Instrumental Analysis 1
CHEM 377	(3)	Instrumental Analysis 2

Organic Chemistry

CHEM 302	(3)	Introductory Organic Chemistry 3
CHEM 352	(3)	Structural Organic Chemistry
CHEM 362*	(2)	Advanced Organic Chemistry Laboratory
CHEM 382	(3)	Organic Chemistry: Natural Products

Physical Chemistry

CHEM 345	(3)	Molecular Properties and Structure 1
CHEM 355	(3)	Molecular Properties and Structure 2
CHEM 393*	(2)	Physical Chemistry Laboratory 2
CHEM 574	(3)	Introductory Polymer Chemistry

11.10.5 Computer Science Courses and Minor Program

The School of Computer Science offers an extensive range of courses for Engineering students interested in computers. Engineering students may obtain a Computer Science Minor as part of their B.Eng., B.S.E. or B.Sc.(Arch.) degree by satisfying the 24-credit requirement from courses passed with a grade of C or better. For further information, please see the School of Computer Science website, *www.cs.mcgill.ca*.

11.10.5.1 Bachelor of Engineering (B.Eng.) - Minor Computer Science (24 credits)

Note: This minor is open to B.Eng., B.S.E. and B.Sc.(Arch.) students in Engineering.

Computer Science Courses

The School of Computer Science offers an extensive range of courses for Engineering students interested in computers. The course taken by students in most B.Eng. programs (COMP 208) and other courses included in the core of the various B.Eng. and B.S.E. programs are listed below.

See the course listing at ttp://www.mcgill.ca/students/courses/calendars/search for other courses offered by the School of Computer Sciences (subject code COMP).

COMP 202	(3)	Introduction to Computing 1
COMP 208	(3)	Computers in Engineering
COMP 250	(3)	Introduction to Computer Science
COMP 302	(3)	Programming Languages and Paradigms

Note: COMP 202 and COMP 208 (compulsory for some Engineering students) do not form part of the Minor in Computer Science.

B.Eng. - Minor Computer Science (24 credits)

Engineering students may obtain the Computer Science minor as part of their B.Eng., B.S.E. or B.Sc.(Arch.) degree by satisfying the 24-credit requirement from courses passed with a grade of C or better. In general, some complementary courses within B.Eng. and B.S.E. programs may be used to satisfy some of these requirements, but the minor will require at least 12 extra credits from Computer Science (COMP) courses beyond those needed for the B.Eng. or B.S.E. degree. Students should consult their departments about the use of complementaries, and credits that can be double counted.

Students should see the undergraduate secretary in the Lorne Trottier Building, Room 2060, to obtain the appropriate forms and to make an appointment to see the minor adviser for approval of their course selection. Forms must be approved before the end of the Course Change (drop/add) period of the student's final term.

For further information, please see the School of Computer Science website at http://www.cs.mcgill.ca.

Required Course

3 credits

COMP 206	(3)	Introduction to Software Systems

Complementary Courses

21 credits

3 credits from the following:

COMP 203	(3)	Introduction to Computing 2
COMP 250	(3)	Introduction to Computer Science

3 credits from the following:

COMP 302	(3)	Programming Languages and Paradigms
COMP 303	(3)	Software Development

3 credits from the following:

COMP 273	(3)	Introduction to Computer Systems
ECSE 221	(3)	Introduction to Computer Engineering

3 credits from the following:

COMP 350	(3)	Numerical Computing
MECH 309	(3)	Numerical Methods in Mechanical Engineering

0-3 credits from the following:

COMP 251	(3)	Data Structures and Algorithms

6-9 credits chosen from other computer science courses at the 300 level or higher.

Notes:

A. COMP 203 and COMP 250 are considered to be equivalent from a prerequisite point of view, and cannot both be taken for credit.

B. COMP 208 may be taken before COMP 250; however, it cannot be taken for credit in the same term or afterwards.

C. COMP 396 (Undergraduate Research Project) cannot be taken for credit towards this minor.

Courses that make considerable use of computing from other departments may also be selected, with the approval of the School of Computer Science. Students should consult with their advisers about counting specific courses.

CIVE 446	(3)	Construction Engineering
CIVE 527	(3)	Renovation and Preservation: Infrastructure
ECSE 461	(3)	Electric Machinery
FINE 445	(3)	Real Estate Finance
MIME 520	(3)	Stability of Rock Slopes
MIME 521	(3)	Stability of Underground Openings
MPMC 321*	(3)	Mécanique des roches et contrôle des terrains

* course offered in French at École Polytechnique in Montreal

11.10.7 Economics Minor

Engineering students who want to complete a minor in economics are required to complete the following program rather than one of the minor concentrations offered by the Department of Economics in the Faculty of Arts section of this publication, unless they have obtained permission from the Faculty of Engineering. Students should consult with a faculty adviser in the Student Affairs Office, Engineering Student Centre for advice on this minor.

11.10.7.1 Bachelor of Engineering (B.Eng.) - Minor Economics (18 credits)

This minor consists of 18 credits of required and complementary courses given in the Economics Department. In addition, it is presumed that all Engineering students will have a sufficient background in statistics. Engineering Economy, MIME 310, does not form part of this minor. Engineering students who want to complete a minor in economics are required to complete the following program rather than one of the minor concentrations offered by the Department of Economics in the Faculty of Arts section of the Calendar, unless they hav

ECON 326	(3)	Ecological Economics
ECON 329	(3)	Economics of Confederation
ECON 330D1	(3)	Macroeconomic Theory
ECON 330D2	(3)	Macroeconomic Theory
ECON 331	(3)	Economic Development: Russia and USSR
ECON 335	(3)	The Japanese Economy
ECON 337	(3)	Introductory Econometrics 1
ECON 344	(3)	The International Economy 1830-1914
ECON 345	(3)	The International Economy since 1914
ECON 347	(3)	Economics of Climate Change
ECON 348	(3)	Urban Economics
ECON 404	(3)	Transportation
ECON 405	(3)	Natural Resource Economics
ECON 406	(3)	Topics in Economic Policy
ECON 408	(3)	Public Sector Economics 1
ECON 409	(3)	Public Sector Economics 2
ECON 411	(3)	Economic Development: A World Area
ECON 416	(3)	Topics in Economic Development 2
ECON 420	(3)	Topics in Economic Theory
ECON 423D1	(3)	International Trade and Finance
ECON 423D2	(3)	International Trade and Finance
ECON 426	(3)	Labour Economics
ECON 434	(3)	Current Economic Problems
ECON 440	(3)	Health Economics
ECON 447	(3)	Economics of Information and Uncertainty
ECON 468	(3)	Econometrics 1 - Honours
ECON 469	(3)	Econometrics 2 - Honours
ECON 525	(3)	Project Analysis
ECON 546	(3)	Game Theory

Note: Mining Engineering students will be permitted to include Mineral Economics (MIME 526) among these 18 credits.

11.10.8 Environmental Engineering Minor

The Environmental Engineering Minor is offered for students in Engineering and in the Department of Bioresource Engineering wishing to pursue studies in this area. Students completing this Minor tak9(3)

A maximum of 12 credits of coursework in the student's major may double-count with the Minor.

Further information may be obtained from Professor Ronald Gehr, Room 487, Macdonald Engineering Building.

To complete the Minor in Environmental Engineering, students must obtain a grade of C or better in all approved courses in the Minor, and satisfy the requirements of both the minor and their major program.

Note: Not all courses listed are offered every year. Students should see the course listing at http://www.mcgill.ca/students/courses/calendars/search to know when a course is offered.

Total minor credit weight: 21-22 credits.

Complementary Courses

21-22 credits

18 credits from Stream A, B or C below

and

One course from the following list:

BREE 327	(3)	Bio-Environmental Engineering
CHEE 230	(3)	Environmental Aspects of Technology
CIVE 225	(4)	Environmental Engineering

Stream A

15 credits* from the Engineering Course List and 3 credits from the Non-Engineering Course List below

*A minimum of 6 credits must be from outside the student's department. A maximum of 6 credits of research project courses may be counted toward this category, provided the project has sufficient environmental engineering content (project requires approval of project supervisor and coordinator of the Minor).

Stream B

15 credits of courses that make up the "Barbados Field Study Semester" below, provided the project for CIVE/AGRI/URBP 519 Sustainable Development Plans has sufficient environmental engineering content (project requires approval of the Coordinator of the Minor);

3 credits chosen from the Engineering Course List below, excluding CHEE 496.

Barbados Field Study Courses

Required Courses

6 credits

URBP 507	(3)	Planning and Infrastructure
URBP 520	(3)	Globalization: Planning and Change

Complementary Courses

9 credits

One of the following cross-listed courses:

W

9 credits of courses specified from the "Barbados Interdisciplinary Tropical Studies (BITS)" field semester below, provided the project has sufficient environmental engineering content (project requires approval of the Coordinator of the Minor);

AEBI 425	(3)	Tropical Energy and Food
AEBI 427	(6)	Barbados Interdisciplinary Project

and 9 credits chosen from the Engineering Course List below, excluding CHEE 496.

Engineering Course List

Courses offered at the Macdonald campus:

BREE 217	(3)	Hydrology and Water Resources
BREE 322	(3)	Organic Waste Management
BREE 416	(3)	Engineering for Land Development
BREE 518	(3)	Bio-Treatment of Wastes

Courses offered at the downtown campus:

ARCH 377	(3)	Energy, Environment and Buildings
CHEE 351	(3)	Separation Processes
CHEE 370	(3)	Elements of Biotechnology
CHEE 496	(3)	Environmental Research Project
CHEE 591	(3)	Environmental Bioremediation
CHEE 592	(3)	Industrial Air Pollution Control
CHEE 593	(3)	Industrial Water Pollution Control
CIVE 225	(4)	Environmental Engineering
CIVE 323	(3)	Hydrology and Water Resources
CIVE 421	(3)	Municipal Systems
CIVE 428	(3)	Water Resources and Hydraulic Engineering
CIVE 430	(3)	Water Treatment and Pollution Control
CIVE 451	(3)	Geoenvironmental Engineering
CIVE 550	(3)	Water Resources Management
CIVE 555	(3)	Environmental Data Analysis
CIVE 572	(3)	Computational Hydraulics
CIVE 573	(3)	Hydraulic Structures
CIVE 574	(3)	Fluid Mechanics of Water Pollution
CIVE 577	(3)	River Engineering
CIVE 584	(3)	Groundwater Engineering
MECH 447	(3)	Combustion
MECH 526	(3)	Manufacturing and the Environment
MECH 534	(3)	Air Pollution Engineering
MECH 535	(3)	Turbomachinery and Propulsion
MIME 422	(3)	Mine Ventilation
MIME 512	(3)	Corrosion and Degradation of Materials
MPMC 328	(3)	Environnement et gestion des rejets miniers
URBP 506	(3)	Environmental Policy and Planning

Non-Engineering Course List

Courses offered at the Macdonald campus:

LSCI 230	(3)	Introductory Microbiology
MICR 331	(3)	Microbial Ecology
MICR 341	(3)	Mechanisms of Pathogenicity
NRSC 437	(3)	Assessing Environmental Impact
RELG 270	(3)	Religious Ethics and the Environment
SOIL 210	(3)	Principles of Soil Science
SOIL 331	(3)	Soil Physics
WILD 375	(3)	Issues: Environmental Sciences
WILD 415	(2)	Conservation Law
WOOD 420	(3)	Environmental Issues: Forestry

Courses offered at the downtown campus:

ANTH 206	(3)	Environment and Culture
BIOL 205	(3)	Biology of Organisms
BIOL 432	(3)	Limnology
CHEM 307	(3)	Analytical Chemistry of Pollutants
CMPL 580	(3)	Environment and the Law
ECON 225	(3)	Economics of the Environment
ECON 326	(3)	Ecological Economics
ECON 347	(3)	Economics of Climate Change
EPSC 549	(3)	Hydrogeology
GEOG 200	(3)	Geographical Perspectives: World Environmental Problems
GEOG 201	(3)	Introductory Geo-Information Science
GEOG 203	(3)	Environmental Systems
GEOG 205	(3)	Global Change: Past, Present and Future
GEOG 302	(3)	Environmental Management 1
GEOG 308	(3)	Principles of Remote Sensing
GEOG 321	(3)	Climatic Environments
GEOG 404	(3)	Environmental Management 2
MIMM 211	(3)	Introductory Microbiology

11.10.9 Minor in Environment

Environmental studies involve the interactions between humans and their natural or technological environment. Environmental problems are frequently comprehensive and complex, and their satisfactory solutions require the synthesis of humanistic, scientific, and institutional knowledge.

The Minor in Environment is offered and administered by the McGill School of Environment (MSE). Inquiries should be directed to Ms. Kathy Roulet, MSE Program Adviser; email: *kathy.roulet@mcgill.ca*, or telephone: 514-398-4306.

Since the program comprises a total of 18 credits for the Minor, additional credits beyond those needed for the B.Eng. degree are required. Students wishing to receive the Minor should prepare a program and have it approved by both their regular Engineering adviser and the MSE adviser. For program details, see *McGill School of Environment > Minor in Environment*.

11.10.10 Minor Programs in Finance, Management, Marketing, and Operations Management

Prerequisite: None

Many engineers begin to assume management functions within a few years of graduation. They can, at this stage, take up the study of economics, behavioural

MIME 561	(3)	Advanced Materials Design
MIME 563	(3)	Hot Deformation of Metals
MIME 566	(3)	Texture, Structure & Properties of Polycrystalline Materials
MIME 569	(3)	Electron Beam Analysis of Materials

11.10.12 Mathematics Minor

Students in the Minor in Mathematics for Engineering students complete 18 credits of mathematics courses (subject code MATH), not including mathematics courses that are required in their engineering program (or equivalent courses) and choose 6 credits from other mathematics-related courses.

In addition to an Engineering adviser, each student in the Minor must have an adviser designated by the Department of Mathematics and Statistics, normally beginning in Year 2. The selection of courses for the Minor is to be done in conjunction with the Minor adviser. Please consult the Department of Mathematics and Statistics for an adviser.

11.10.12.1 Bachelor of Engineering (B.Eng.) - Minor Mathematics (24 credits)

Note: The Mathematics Minor is open to all students in the Faculty of Engineering (B.Eng., B.S.E. and B.Sc.(Arch.).

This minor for Engineering students requires satisfactory passes in 24 credits of approved courses in Mathematics.

In addition to an Engineering adviser, each student in the minor program must have an adviser designated by the Department of Mathematics and Statistics, normally beginning in their U2 year. The selection of courses is to be done in conjunction with the minor adviser. Please consult the Department of Mathematics and Statistics for an adviser.

Course Selection

At least 18 credits must be chosen from the Mathematics and Statistics courses approved for the Mathematics Major or Honours program, or from the following courses:

MATH 249	(3)	Honours Complex Variables
MATH 363	(3)	Discrete Mathematics
MATH 381	(3)	Complex Variables and Transforms

The remaining credits may be chosen from mathematically allied courses.

The following courses cannot be used to

One of the required courses is a work term for which enrolment may be limited. Interested students should contact the coordinator, Professor Hani Mitri, Room 121, Adams Building.

11.10.13.1 Bachelor of Engineering (B.Eng.) - Minor Mining Engineering (24 credits)

Students in Engineering may obtain the Mining Engineering Minor by completing 24 credits of required and complementary courses, as listed below.

One of the required courses is a work term for which enrolment may be limited. Interested students should contact the coordinator, Professor Hani Mitri, Room 121, Adams Building.

Required Courses

12 credits

MIME 200	(3)	Introduction to the Minerals Industry
MIME 291	(2)	Industrial Work Period 2
MIME 313	(1)	Mining Science and Technology Seminar
MIME 322	(3)	Rock Fragmentation
MIME 333	(3)	Materials Handling

Complementary Courses

12 credits selected from the following lists:

List A: Mining Engineering

6-12 credits from the following:

MIME 320	(3)	Extraction of Energy Resources
MIME 323	(3)	Rock and Soil Mass Characterization
MIME 325	(3)	Mineral Industry Economics
MIME 341	(3)	Introduction to Mineral Processing
MIME 419	(3)	Surface Mining
MIME 422	(3)	Mine Ventilation
MIME 426	(3)	Development and Services
MIME 520	(3)	Stability of Rock Slopes
MIME 521	(3)	Stability of Underground Openings
MIME 526	(3)	Mineral Economics

List B: Mechanical Engineering

0-6 credits from the following:

MECH 497	(3)	Value Engineering
MECH 554	(3)	Microprocessors for Mechanical Systems
MECH 557	(3)	Mechatronic Design
MECH 572	(3)	Introduction to Robotics
MECH 573	(3)	Mechanics of Robotic Systems
MECH 577	(3)	Optimum Design

List C: Civil Engineering

0-6 credits from the following:

CIVE 416	(3)	Geotechnical Engineering
CIVE 451	(3)	Geoenvironmental Engineering

CIVE 462	(3)	Design of Steel Structures
CIVE 463	(3)	Design of Concrete Structures
CIVE 527	(3)	Renovation and Preservation: Infrastructure

List D: Chemical Engineering

0-6 credits from the following:

CHEE 453	(4)	Process Design
CHEE 455	(4)	Process Control
CHEE 484	(3)	Materials Engineering

11.10.14 Physics Minor

Students in Honours Electrical Engineering taking the Physics Minor take 9 credits of required courses in thermal physics and honours quantum physics and choose three other physics courses (subject code PHYS).

Interested students should contact the Department of Physics concerning this Minor.

11.10.14.1 Bachelor of Engineering (B.Eng.) - Minor Physics (18 credits)

Students in Honours Electrical Engineering may obtain this minor as part of their B.Eng. degree by completing 18 credits of physics courses, as listed below.

Please consult the Department of Physics for an adviser.

Required Courses

9 credits

PHYS 253	(3)	Thermal Physics
PHYS 357*	(3)	Honours Quantum Physics 1
PHYS 457*	(3)	Honours Quantum Physics 2

* Students who take PHYS 357 and PHYS 457 can omit PHYS 271 from their normal Electrical Engineering program.

Complementary Courses

9 credits from the following:

PHYS 332	(3)	Physics of Fluids
PHYS 362	(3)	Statistical Mechanics
		Honours Classical Mechanicshould contact the Depassical2ir1 67.52 332.9PH170.52 285.064 Tm(PHY5(.22 332.Gener

Students taking the Minor choose 18 credits from courses in technological entrepreneurship (entrepreneurship, marketing management, organization policy, marketing of technology, leadership and human resources management). Students can also choose to take business plan design and project courses, which gives students an opportunity to design a business plan and develop a technology or engineering project.

Students considering this Minor should consult with a faculty adviser in the Student Affairs Office, Engineering Student Centre, Frank Dawson Adams, Suite 22.

11.10.15.1 Bachelor of Engineering (B.Eng.) - Minor Technological Entrepreneurship (18 credits)

This minor is offered jointly by the Faculties of Engineering and Management. It will appeal to those students who have a concept, process or product idea in mind and who want to explore the opportunity of commercializing it. It will also be of interest to students who have a general interest in entrepreneurship and intend to pursue a career in small and medium-sized high technology/engineering companies.

Engineering students (including B.Eng. and B.Sc.(Arch.) students) may obtain the Technological Entrepreneurship Minor by completing six courses (18 credits). B.Eng. and B.S.E. student may double-count up to two courses (6 credits) of Complementary Studies (Humanities and Social Sciences courses, Group B) toward the Minor.

Students considering this minor should consult with a faculty adviser in the Student Affairs Office, Engineering Student Centre, Frank Dawson Adams, Suite 22.

Complementary Courses

18 credits (six courses) from the following:

BUSA 465	(3)	Technological Entrepreneurship
FACC 500	(3)	Technology Business Plan Design
FACC 501	(3)	Technology Business Plan Project
MGCR 352	(3)	Marketing Management 1
MGCR 423	(3)	Organizational Policy
MRKT 360	(3)	Marketing of Technology
ORGB 321	(3)	Leadership
ORGB 423	(3)	Human Resources Management

11.10.16 Software Engineering Minor

This Minor will prepare an engineering student for a career in software engineering. It will provide a foundation in basic computer science, computer programming and software engineering practice.

Students considering this Minor should consult with a faculty adviser in the Student Affairs Office, Engineering Student Centre, Frank Dawson Adams, Suite 22.

11.10.16.1 Bachelor of Engineering (B.Eng.) - Minor Software Engineering (24 credits)

The Software Engineering Minor will prepare an engineering student for a career in software engineering. It will provide a foundation in basic computer science, computer programming and software engineering practice.

This minor consists of 24 credits (eight courses). Up to four courses (12 credits) may be double-counted for credit towards the B. Eng. degree in Electrical Engineering or C(24(-(of interestngineering oreondation 0 1 67.52 241.23)Tj1 0 0 1 to tw)Tj1 0 0 1 269.704h1 0urses). U0F0 8.6 Tf.52 265.762 Tm.901 Tm(F)TTjF0 8

COMP 203	(3)	Introduction to Computing 2
COMP 250	(3)	Introduction to Computer Science

3-12 credits from the following engineering courses:

CHEE 458	(3)	Computer Applications
CHEE 571	(3)	Small Computer Applications: Chemical Engineering
CIVE 460	(3)	Matrix Structural Analysis
CIVE 550	(3)	Water Resources Management
CIVE 572	(3)	Computational Hydraulics
ECSE 322	(3)	Computer Engineering
ECSE 420	(3)	Parallel Computing
ECSE 421	(3)	Embedded Systems
ECSE 422	(3)	Fault Tolerant Computing
ECSE 424	(3)	Human-Computer Interaction
ECSE 427	(3)	Operating Systems
ECSE 429	(3)	Software Validation
ECSE 526	(3)	Artificial Intelligence
ECSE 532	(3)	Computer Graphics
MECH 474	(3)	Selected Topics in Operations Research
MECH 524	(3)	Computer Integrated Manufacturing
MECH 539	(3)	Computational Aerodynamics
MECH 545	(3)	Advanced Stress Analysis
MECH 576	(3)	Geometry in Mechanics

0-6 credits from the following computer science courses (no more than 6 credits will count toward the minor):

COMP 302	(3)	Programming Languages and Paradigms
COMP 335	(3)	Software Engineering Methods
COMP 420	(3)	Secondary Storage Algorithms and Data Structures
COMP 421	(3)	Database Systems
COMP 424	(3)	Artificial Intelligence
COMP 431	(3)	Algorithms for Engineers
COMP 527	(3)	Logic and Computation