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This publication provides guidance to prospects, applicants, students, faculty and staff.

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1 About the Faculty of Engineering

The Faculty currently includes six engineering departments and two schools, and houses three institutes:

Departments

Bioengineering
Chemical Engineering
Civil Engineering
Electrical and Computer Engineering
Mechanical Engineering
Mining and Materials Engineering

Schools

The Peter Guo-hua Fu School of Architecture
Urban Planning

Institutes

Trottier Institute for Sustainability in Engineering and Design (TISED) (Website: mcgill.ca/tised)
McGill Institute for Advanced Materials (MIAM) (Website: mcgill.ca/miam) (established by the Faculties of Engineering and Science)
McGill Institute for Aerospace Engineering (MIAE) (Website: mcgill.ca/miae)

The Faculty serves approximately 3,300 undergraduate students and 1,300 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 at [Faculty of Engineering > Graduate](#).

The academic programs are divided into required and complementary sections. The required courses emphasize 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 a particular interest in depth. For program details and requirements, refer to [section 9: Browse Academic Units & Programs](#).

The **Engineering Internship Program** provides engineering students with the opportunity to participate in four-, eight-, twelve-, or sixteen1 143.896 306.635

The **McGill Engineering Student Centre** (Student Affairs Office, Career Centre, Peer Tutoring Services) and the **Office of the Associate Dean** (Student Affairs) are located at the following address:

3450 University Street
Montreal QC H3A 0E8
Frank Dawson Adams Building, Suite 22
Telephone: 514-398-7257
McGill Engineering Student Centre website: mcgill.ca/engineering/students/undergraduate/mesc

2.2 About the Faculty of Engineering

The mission of the Faculty of Engineering is to contribute to the advancement of learning and to the socioeconomic development of Quebec and Canada, through teaching and research activities at the highest international standards of quality.

Goals:

- To prepare graduates for productive professional careers through the provision of accredited bachelor's programs;
- To train students through focused professional programs to attain the forefront of their fields;
- To perform research and other scholarly activities which achieve international recognition;
- To ensure that technological innovations developed through research are transferred to industry; and
- To provide a stimulating environment for teaching, learning, and research.

In this section, you will find up-to-date information about the Faculty and about the undergraduate programs and courses it offers. *Graduate Studies* in the Faculty of Engineering is also offered by McGill.

You will find information on the following topics (and others):

- [section 1: About the Faculty of Engineering](#)
- [section 3: Degrees and Requirements for Professional Registration](#)
- [section 6: Student Activities](#)
- [section 8: Engineering Internship Progr](#)

4 Admission Requirements

The Faculty of Engineering offers programs leading to the degrees of B.Eng. and B.Sc.(Arch.). Enrolment in Engineering programs is limited. For detailed information on admissions requirements, see the *Undergraduate Admissions Guide* at mcgill.ca/applying.

5 Student Progress

The length of the B.Eng. and B.Sc.(Arch.) programs varies depending on the program and basis of admission. You can find the curriculum for your program on the website of your department or school. See

- Internships must be related to the student's degree program.
- International students are also eligible, but will require a co-op work permit to participate.
- Students cannot miss more than two academic terms for internships.
- Students may be eligible to pursue one academic course (maximum of 4 credits) while on an approved internship term, pending certain conditions.

9 Browse Academic Units & Programs

The programs and courses in the following sections have been approved for the 2024-2025 session as listed.

9.1 Architecture

9.1.1 Location

Macdonald-Harrington Building, Room 201
815 Sherbrooke Street West
Montreal QC H3A 0C2
Telephone: 514-398-6700
Fax: 514-398-7372
Website: mcgill.ca/architecture

9.1.2 About the Peter Guo-hua Fu School of Architecture

Founded in 1896, the Peter Guo-hua Fu School of Architecture at McGill University offers(v)TeAbout the P

- complete the B.Sc.(Arch.) degree, including the series of required and complementary courses stipulated for professional studies, with a minimum CGPA of 3.00. Please note that the minimum CGPA requirement does not guarantee entry into M.Arch program; and
- submit a portfolio of work executed in the sequence of six design studios, as well as samples of professional and personal work.

Further information on the M.Arch. (Professional) program and application procedures is available at mcgill.ca/architecture/programs/professional/prospective-students/application-procedures.

9.1.4.1 Student Exchanges

A limited number of qualified students may participate in an exchange with schools of architecture at other universities that have agreements with the McGill School of Architecture, for a maximum of one term in the second year of the B.Sc.(Arch.) program. These include the following:

- Università Iuav di Venezia (Venice, Italy);
- Fakultät für Architektur und Raumplanung;
- Université Catholique de Louvain (Louvain, Brussels, and Tournai, Belgium);
- Scuola di Architettura Civile Politecnico di Milano (Leonardo) (Milan, Italy);
- College of Architecture and Urban Planning, Tongji University (Shanghai, China);
- École nationale supérieure d'architecture de Paris-Belleville (Paris, France);
- École nationale supérieure d'architecture de Grenoble (Grenoble, France).

9.1.5 Ancillary Academic Facilities

Laboratories and Workshops

Media Centre – Juan Osorio, Media Technician

Workshop Facilities – Athanasia Blounas, Technician; David Speller, Technician

Library

Blackader-Lauterman Collection of Architecture and Art, located in the Redpath Library – Emily Jaeger-McEnroe, Liaison Librarian

Collections

The John Bland Canadian Architecture Collection – Jennifer Garland, Assistant Head Librarian, Rare Books and Special Collections

9.1.6 Bachelor of Science (B.Sc.) (Architecture) - Architecture (126 credits)

Program credit weight: 126 credits

Program credit weight for CEGEP students: 98 credits

The B.Sc.(Arch.) program provides conceptual, technical, and procedural foundations for the professional M.Arch. program, which is accredited by the Canadian Architectural Certification Board and recognized as accredited by the National Council of Architectural Registration Boards in the US. Students entering the B.Sc.(Arch.) program complete first-year courses in general studies (including sciences, humanities, and social sciences), for which individuals entering with the Québec Diploma of Collegial Studies in Arts and Science or Pure and Applied Science (or equivalent) are generally granted transfer credits. All students then complete six terms of immersion in architecture, centered in studio courses exploring principles of design, norms of representation, cultures of construction, and the human experience of architecture. Studio-based learning is complemented by lecture courses on foundational knowledge. Complementary courses provide further opportunities to learn about how culture intersects with technology in the work of architecture, and students select electives to customize their learning experience.

Required Year 0 (Freshman) Courses

28 credits

Generally, students admitted to the Architecture program from Quebec CEGEPs are granted transfer credit for the Year 0 (Freshman) courses and enter a 98-credit (six-term) program.

Course choices must be made through consultation with the Student Adviser for the Professional Programs.

All Year 0 students must successfully complete 10 credits from the following:

MATH 133	(3)	Linear Algebra and Geometry
MATH 140	(3)	Calculus 1
PHYS 131*	(4)	Mechanics and Waves

All Year 0 students must also successfully complete 16 credits as follows:

3 credits from among any 100- or 200-level courses with the subject codes of ATOC (Atmospheric and Oceanic Sciences), COMP (Computer Science), ENVR (Environment), and EPSC (Earth and Planetary Sciences).

15 credits from among any 100- or 200-level courses with the subject codes of AFRI (African Studies),

ARCH 517	(3)	Sustainable Residential Development
ARCH 519	(3)	Field Course Abroad
ARCH 520	(3)	Montreal: Urban Morphology
ARCH 523	(3)	Significant Texts and Buildings
ARCH 525	(3)	Seminar on Analysis and Theory
ARCH 526	(3)	Philosophy of Structure
ARCH 528	(3)	History of Housing
ARCH 531	(3)	Architectural Intentions Vitruvius - Renaissance
ARCH 532	(3)	Origins of Modern Architecture
ARCH 535	(3)	History of Architecture in Canada
ARCH 536	(3)	Heritage Conservation
ARCH 540	(3)	Selected Topics in Architecture 1
ARCH 541	(3)	Selected Topics in Architecture 2
ARCH 542	(3)	Selected Topics in Architecture 3
ARCH 543	(3)	Selected Topics in Architecture 4
ARCH 562	(3)	Innovative Homes and Communities
ARCH 564	(3)	Design for Development
ARCH 566	(3)	Cultural Landscapes Seminar

Elective Courses (9 credits)

9 credits of electiv

Program credit weight for Quebec CEGEP students: 122-123 credits

Program credit weight for out-of-province students: 142-143 credits

The B.Eng.; Major in Bioengineering will 1) provide students with the ability to apply systematic knowledge of biology, physical sciences and mathematics; and sound engineering foundations in order to solve problems of a biological nature; and 2) prepare students for the broad area of bioengineering, incorporating both biology-focused biological engineering and medicine-focused biomedical engineering.

Students will acquire fundamental knowledge in bioengineering-related natural sciences and mathematics, as well as in the foundations of general engineering and bioengineering. Students will also acquire knowledge in one area of specialization of bioengineering: 1) biological materials and biomechanics; 2) biomolecular and cellular engineering; or 3) biological information and computation

Required Year 0 (Freshman) Courses

29 credits

Generally, students admitted to Engineering from Quebec CEGEPs are granted transfer credits for Year 0 (Freshman) courses, except BIOL 112, and enter a 122-123-credit program. Students from Quebec CEGEPs who have successfully completed a course at CEGEP that is equivalent to BIOL 112 may obtain transfer credits for this course by passing the McGill Science Placement Exam for BIOL 112. For information on transfer credit for French Baccalaureate, International Baccalaureate exams, Advanced Placement exams, Advanced Levels and Science Placement Exams, see www.mcgill.ca/engineering/student/sao/newstudents and select your term of admission.

BIOL 112	(3)	Cell and Molecular Biology
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

Note: FACC 100 (Introduction to the Engineering Profession) must be taken during the first year of study.

Required Non-Departmental Courses

30 credits

CHEM 212**	(4)	Introductory Organic Chemistry 1
COMP 208	(3)	Computer Programming for Physical Sciences and Engineering
FACC 100*	(1)	Introduction to the Engineering Profession
FACC 250	(0)	Responsibilities of the Professional Engineer
FACC 300	(3)	Engineering Economy
FACC 400	(1)	Engineering Professional Practice
MATH 203	(3)	Principles of Statistics 1
MATH 262	(3)	Intermediate Calculus
MATH 263	(3)	Ordinary Differential Equations for Engineers
MATH 264	(3)	Advanced Calculus for Engineers
PHYS 319	(3)	Introduction to Biophysics
WCOM 206	(3)	Communication in Engineering

* Note FACC 100 (Introduction to the Engineering Profession) must be taken during the first year of study.

** Students from a CEGEP background who have completed a CEGEP course equivalent to CHEM 212 may obtain transfer credits for this course by passing the McGill Placement Exam before the start of their first term. For information on Science Placement Exams, see www.mcgill.ca/exams/dates/science. CEGEP students who do not successfully complete the CHEM 212 Placement Exam must take CHEM 212 at McGill, as outlined in the program requirements.

Required Bioengineering Courses

50 credits

BIEN 200	(2)	Introduction to Bioengineering
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BIEN 210

(3)

Electrical and Optical Properties of Biological Systems
Introduction to Ph

BIEN 515	(3)	Special Topics in Bioengineering 2
BIEN 525	(3)	Special Topics in Bioengineering 3
BIEN 530	(3)	Imaging and Bioanalytical Instrumentation
BIEN 535	(3)	Electron Microscopy and 3D Imaging for Biological Materials
BIEN 545	(3)	Diagnostic Devices at the Point-of-Care
BIEN 550	(3)	Biomolecular Devices
BIEN 580	(3)	Synthetic Biology
BIEN 585	(3)	Metabolic Engineering
BMDE 503	(3)	Biomedical Instrumentation
BMDE 504	(3)	Biomaterials and Bioperformance
BMDE 505	(3)	Cell and Tissue Engineering
BMDE 512	(3)	Finite-Element Modelling in Biomedical Engineering
CHEE 563*	(3)	Biofluids and Cardiovascular Mechanics
CIVE 281	(3)	Analytical Mechanics
MECH 321	(3)	Mechanics of Deformable Solids
MECH 547	(3)	Mechanics of Biological Materials
MECH 561	(3)	Biomechanics of Musculoskeletal Systems
MECH 563*	(3)	Biofluids and Cardiovascular Mechanics
MECH 572	(3)	Mechanics and Control of Robotic Manipulators
MIME 470	(3)	Engineering Biomaterials
MIME 473	(3)	Introduction to Computational Materials Design
SEAD 515	(3)	Climate Change Adaptation and Engineering Infrastructure
SEAD 520	(3)	Life Cycle-Based Environmental Footprinting
SEAD 540	(3)	Industrial Ecology and Systems
SEAD 550	(3)	Decision-Making for Sustainability in Engineering and Design

*Note: Students may choose only one of CHEE 563 and MECH 563 Biofluids and Cardiovascular Mechanics

NOTE: Maximum 6 credits of SEAD courses are allowed.

Stream 2: Biomolecular and Cellular Engineering (24-25 credits)

12 credits from List A

12-13 credits from List B

List A

BIEN 310	(3)	Introduction to Biomolecular Engineering
BIEN 320	(3)	Molecular, Cellular and Tissue Biomechanics
BIEN 550	(3)	Biomolecular Devices
BIEN 590	(3)	Cell Culture Engineering

List B

BIEN 330	(3)	Tissue Engineering and Regenerative Medicine
BIEN 410	(3)	Computational Methods in Biomolecular Engineering
BIEN 414	(3)	Fundamentals and Rheology of Biological Fluids
BIEN 450	(3)	Biological Structures and Assemblies

BIEN 462	(3)	Engineering Principles in Physiological Systems
BIEN 500	(3)	Special Topics in Bioengineering 1
BIEN 505	(3)	Medical Technology Innovation and Development
BIEN 510	(3)	Engineered Nanomaterials for Biomedical Applications
BIEN 515	(3)	Special Topics in Bioengineering 2
BIEN 525	(3)	Special Topics in Bioengineering 3
BIEN 530	(3)	Imaging and Bioanalytical Instrumentation
BIEN 535	(3)	Electron Microscopy and 3D Imaging for Biological Materials
BIEN 540	(3)	Information Storage and Processing in Biological Systems
BIEN 545	(3)	Diagnostic Devices at the Point-of-Care
BIEN 570	(3)	Active Mechanics in Biology
BIEN 580	(3)	Synthetic Biology
BIEN 585	(3)	Metabolic Engineering
BIEN 595	(3)	Advanced Biomolecular Systems Modelling
BMDE 503	(3)	Biomedical Instrumentation
BMDE 508	(3)	Introduction to Micro and Nano-Bioengineering
CIVE 281	(3)	Analytical Mechanics
CIVE 557	(3)	Microbiology for Environmental Engineering
PHYS 534	(3)	Nanoscience and Nanotechnology
SEAD 510	(4)	Energy Analysis
SEAD 515	(3)	Climate Change Adaptation and Engineering Infrastructure
SEAD 520	(3)	Life Cycle-Based Environmental Footprinting
SEAD 540	(3)	Industrial Ecology and Systems
SEAD 550	(3)	Decision-Making for Sustainability in Engineering and Design

NOTE: Maximum 6 credits of SEAD courses are allowed.

Stream 3: Biological Information and Computation (24-25 credits)

12 credits from List A

12-13 credits from List B

List A

BIEN 310	(3)	Introduction to Biomolecular Engineering
BIEN 410	(3)	Computational Methods in Biomolecular Engineering
BIEN 530	(3)	Imaging and Bioanalytical Instrumentation
BIEN 540	(3)	Information Storage and Processing in Biological Systems

List B

BIEN 414	(3)	Fundamentals and Rheology of Biological Fluids
BIEN 450	(3)	Biological Structures and Assemblies
BIEN 462	(3)	Engineering Principles in Physiological Systems
BIEN 500	(3)	Special Topics in Bioengineering 1
BIEN 505	(3)	Medical Technology Innovation and Development
BIEN 515	(3)	Special Topics in Bioengineering 2

BIEN 525	(3)	Special Topics in Bioengineering 3
BIEN 535	(3)	Electron Microscopy and 3D Imaging for Biological Materials
BIEN 545	(3)	Diagnostic Devices at the Point-of-Care
BIEN 580	(3)	Synthetic Biology
BIEN 585	(3)	Metabolic Engineering
BIEN 595	(3)	Advanced Biomolecular Systems Modelling
BMDE 502	(3)	BME Modelling and Identification
BMDE 503	(3)	Biomedical Instrumentation
BMDE 512	(3)	Finite-Element Modelling in Biomedical Engineering
BMDE 519	(3)	Biomedical Signals and Systems
CIVE 281	(3)	Analytical Mechanics
COMP 250	(3)	Introduction to Computer Science
COMP 251	(3)	Algorithms and Data Structures
COMP 462	(3)	Computational Biology Methods
COMP 551	(4)	Applied Machine Learning
ECSE 415	(3)	Introduction to Computer Vision
MECH 513	(3)	Control Systems
MECH 572	(3)	Mechanics and Control of Robotic Manipulators
SEAD 510	(4)	Energy Analysis
SEAD 515	(3)	Climate Change Adaptation and Engineering Infrastructure
SEAD 520	(3)	Life Cycle-Based Environmental Footprinting
SEAD 540	(3)	Industrial Ecology and Systems
SEAD 550	(3)	Decision-Making for Sustainability in Engineering and Design

NOTE: Students in Stream 3 may only take one of the two 4 credit list B TCs (either COMP 551 or SEAD 510 or another 3 credit list B TC)

NOTE: Maximum 6 credits of SEAD courses are allowed.

Complementary Studies

9 credits

Group A - Impact of Technology on Society

3 credits from the following:

ANTH 212	(3)	Anthropology of Development
ECON 225	(3)	Economics of the Environment
ECON 347	(3)	Economics of Climate Change
ENVR 201	(3)	Society, Environment and Sustainability
GEOG 200	(3)	Geographical Perspectives: World Environmental Problems
GEOG 203	(3)	Environmental Systems
		Global Change: P

SOCI 312	(3)	Sociology of Work and Industry
URBP 201	(3)	Planning the 21st Century City

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

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

Generally, students admitted to ⁽³⁾Engineering from Quebec CEGEP's are granted transfer credits for 3 credits (one course) from the Complementary Studies Group B list.

6 credits of courses at the 200-level or higher from the following departments:

Anthropology (ANTH)

Economics (any 200- or 300-level course excluding 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) (excluding courses that principally impart language skills, such as Sanskrit, Tibetan, Tamil, New Testament Greek, and Biblical Hebrew)***

School of Social Work (SWRK)

Sociology (excluding SOCI 350)

OR from the following courses:

ARCH 528	(3)	History of Housing
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Technological Entrepreneurship 22ubj1 0 0 1 11 165.831 436.321 Tm((3))Tj1 0 0 1 70.31 436.321 B(3))Tj1 0 01 1470.31 436.

Hist204 am(Philosophy)Tj1 0 2941365.247 262.041 storyMarommistcs2ubj1 0 0 1 11 165.247 262.041 Tm((3))Tj1 0 0 1

0-9 credits

Students from Quebec CEGEPs must tak

9.3.3 Academic Programs

The Chemical Engineering program comprises 143 credits (114 credits for those who completed the Quebec CEGEP program in Pure and Applied Sciences). Students must obtain a grade of C or better in all core courses. For the Department of Chemical Engineering, core courses include all required courses (departmental and non-departmental) as well as technical complementary courses.

9.3.4 Canadian Society for Chemical Engineering

The *Chemical Engineering Student Society* has for many years been affiliated with both the *CSChE* (Canadian Society for Chemical Engineering) which is one of the member societies of the Chemical Institute of Canada (CIC) and with the *AIChE* (American Institute of Chemical Engineers). *CSChE membership* is free for all full-time undergraduate students at McGill. CSChE and AIChE members gain access to a range of benefits, including registration rates at the Canadian Chemical Engineering Conference, as well as member rates in the American Chemical Society (ACS) and affiliated events. The student chapter also organizes a series of local social, educational, and sporting events. Recent events have included student–professor banquets, parties, speakers, broomball games, and joint events with the Montreal Section of the CIC (www.cicmontrealsection.ca), which gives students a chance to network with practising chemical engineers in the Montreal region.

9.3.5 Bachelor of Engineering (B.Eng.) - Chemical Engineering (143 credits)

Program credit weight: 143 credits

Program credit weight for Quebec CEGEP students: 114 credits

Program credit weight for out-of-province students: 143 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 fundamental science, biology, will find several courses in the chemical engineering curriculum that 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, experimenting, planning, and communication skills are emphasized in courses throughout the core curriculum.

Certain students who take advantage of Summer session courses can complete the departmental program in three calendar years.

In some cases, students from university science disciplines have sufficient credits to complete the requirements for the B.Eng. (Chemical) program in two and a half years. Those concerned should discuss this with their adviser.

Students must obtain a grade of C or better in all core courses. For the Department of Chemical Engineering, core courses include all required courses (departmental and non-departmental) as well as technical complementary courses.

Note to CEGEP students

If you have successfully completed a course at CEGEP that is equivalent to CHEM 212 or CHEM 234, you may obtain transfer credits for either or both courses by passing the McGill Science Placement Exam for the course(s). You must complete an application form available on the Science Placement Exam website and an application fee will be charged to your student account. Science placement exams take place in August and September before classes begin. If you pass the exam(s), transfer credits for the course(s) will be reflected on your transcript and your program credit requirements will be decreased to reflect these transfer credits. For information on Science Placement Exams, including application deadlines, the application form, application fee, dates, times, and location of the exams, see www.mcgill.ca/exams/dates/science. If you do not pass the placement exams, you must register for CHEM 212 and CHEM 234 during your studies at McGill as outlined in your program requirements.

Required Year 0 (Freshman) Courses

29 credits

Generally, students admitted to Engineering from Quebec CEGEPs are granted transfer credit for these Year 0 (Freshman) courses and enter a 114-credit 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/current-students/undergraduate/new-students> and select your term of admission.

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

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).

Note: FACC 100 (Introduction to the Engineering Profession) must be taken during the first year of study.

Required Non-Departmental Courses

24 credits

CHEM 212	(4)	Introductory Organic Chemistry 1
CHEM 234	(3)	Topics in Organic Chemistry
COMP 208	(3)	Computer Programming for Physical Sciences and Engineering
FACC 100*	(1)	Introduction to the Engineering Profession
FACC 250	(0)	Responsibilities of the Professional Engineer
FACC 300	(3)	Engineering Economy
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

* Note: FACC 100 (Introduction to the Engineering Profession) must be taken during the first year of study.

Required Chemical Engineering Courses

75 credits

CHEE 200	(3)	Chemical Engineering Principles 1
CHEE 204	(3)	Chemical Engineering Principles 2
CHEE 220	(3)	Chemical Engineering Thermodynamics
CHEE 231	(3)	Data Analysis and Design of Experiments
CHEE 291	(4)	Instrumentation and Measurement 1
CHEE 310	(3)	Physical Chemistry for Engineers
CHEE 314	(3)	Fluid Mechanics
CHEE 315	(3)	Heat and Mass Transfer
CHEE 351	(3)	Separation Processes
CHEE 370	(3)	Elements of Biotechnology
CHEE 380	(3)	Materials Science
CHEE 390	(3)	Computational Methods in Chemical Engineering
CHEE 400	(3)	Principles of Sustainable Energy Conversion
CHEE 401	(3)	Energy Systems Engineering
CHEE 423	(3)	Chemical Reaction Engineering
CHEE 440	(3)	Process Modelling
CHEE 453	(4)	Process Design
CHEE 455	(3)	Process Control
CHEE 456D1	(4.5)	Design Project
CHEE 456D2	(4.5)	Design Project
CHEE 474	(3)	Biochemical Engineering
CHEE 484	(3)	Materials Engineering
CHEE 491	(4)	Instrumentation and Measurement 2

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, students use the technical complementaries to increase the breadth of their chemical engineering training.

List A

3-9 credits from the following:

Resource Recovery and Circular Use

List C

0-3 credits

The remaining credits, up to a maximum of 3 credits, may be taken from other suitable undergraduate courses in the Faculty of Engineering, with departmental permission.

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
ECON 225	(3)	Economics of the Environment
ECON 347	(3)	Economics of Climate Change
ENVR 201	(3)	Society, Environment and Sustainability
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
MGPO 440*	(3)	Strategies for Sustainability
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

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

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 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) (excluding courses that principally impart language skills, such as Sanskrit, Tibetan, Tamil, New Testament Greek, and Biblical Hebrew) ***

School of Social Work (SWRK)

Sociology (excluding SOCI 350)

OR 3 credits from the following:

ARCH 528	(3)	History of Housing
BUSA 465*	(3)	Technological Entrepreneurship
CLAS 203	(3)	Greek Mythology
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
HISP 225	(3)	Hispanic Civilization 1
HISP 226	(3)	Hispanic Civilization 2
INDR 294*	(3)	Introduction to Labour-Management Relations
INTG 201**	(3)	Integrated Management Essentials 1
INTG 202**	(3)	Integrated Management Essentials 2
MATH 338	(3)	History and Philosophy of Mathematics
MGCR 222*	(3)	Introduction to Organizational Behaviour
MGCR 352*	(3)	Principles of Marketing
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>.

** Note: INTG 201 and INTG 202 are not open to students who have taken certain Management courses. Please see the INTG 201 and INTG 202 course information for a list of these courses.

*** If you are uncertain whether or not a course principally imparts language skills, please see an adviser in the McGill Engineering Student Centre (Frank Dawson Adams Building, Room 22) or email an adviser.

Note regarding language courses: Language courses are not accepted to satisfy the Complementary Studies Group B requirement, effective for students who entered the program as of Fall 2017.

9.3.5.1 More about B.Eng. Degree in Chemical Engineering

Courses CHEE 582 and CHEE 584 comprise a **Polymeric Materials** course sequence, while courses CHEE 380 and CHEE 484 present fundamental aspects of materials science and engineering, respectively. Additional courses in the polymer materials area are available in the Chemistry Department (e.g., CHEM 574). The Department has considerable expertise in the polymer area.

Courses CHEE 370 and CHEE 474 make up a sequence in **Biochemical Engineering and Biotechnology**. Students interested in this area may take additional courses, particularly those offered by the [section 9.2: Bioengineering](#) (Faculty of Engineering); by the [Department of Food Science and Agricultural Chemistry \(Faculty of Agricultural and Environmental Sciences\)](#); and 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.

A third sequence of courses is offered in **Energy**, comprising CHEE 400 Principles of Energy Conversion and CHEE 401 Energy Systems Engineering. Additional courses that offer topics related to energy are CHEE 511 Catalysis for Sustainable Fuels and Chemicals and CHEE 541 Electrochemical Engineering.

The fourth area in which there is a sequence of courses is **Pollution Control**. The Department offers three courses in this area: CHEE 521, CHEE 591, 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 in the [section 9.11.11: Bachelor of Engineering \(B.Eng.\) - Minor Environmental Engineering \(21 credits\)](#).

A Minor in Biotechnology is also offered by the Faculties of Engineering and Science with emphasis on molecular biology and chemical engineering processes. A full description of the program appears in the [section 9.11.5: Bachelor of Engineering \(B.Eng.\) - Minor Biotechnology \(for Engineering Students\) \(24 credits\)](#).



Note: 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 (600-level) CHEE courses as technical complementaries.

9.4 Civil Engineering

9.4.1 Location

Macdonald Engineering Building, Room 495
 817 Sherbrooke Street West
 Montreal QC H3A 0C3
 Telephone: 514-398-6860

Fax: 514-398-7361
Email: ugradinfo.civil@mcgill.ca
Website: mcgill.ca/civil

9.4.2 About the Department of Civil Engineering

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, rehabilitation, and sustainability. Examples include buildings; bridges; roads; railways; dams; facilities for water supply and treatment; waste disposal; and transportation system.

With the aging and deterioration of an already vast infrastructure, maintenance and rehabilitation have become increasingly important roles of the civil engineering professional. In the midst of worldwide concern about the detrimental impact of human activities on the environment, civil engineers are now in the forefront of developing and providing the means for both prevention and remediation of environmental pollution.

Students who wish to extend their knowledge in certain areas beyond the range that the program's complementary courses allow can also take a **minor**. Minors are available in fields such as:

- Arts;
- Economics;
- Management;
- Environmental Engineering;
- Construction Engineering and Management;
- and others.

These require additional credits to be taken from a specified list of topics relating to the chosen field. Further information on the various minors may be found in [section 9.11: Minor Programs](#). Details on how minors can be accommodated within the Civil Engineering program will be made available during preregistration counselling.

9.4.3 Academic Programs

Considerable freedom exists for students to influence the nature of the program of study which they follow in the Department of Civil Engineering. A variety of advanced **complementary courses** is offered in five main groupings:

- Environmental Engineering;
- Geotechnical and Geoenvironmental Engineering;
- Water Resources and Hydraulic Engineering;
- Structural Engineering;
- Transportation Engineering.

Guidance on the sequence in which required core courses should be taken is provided for students in the form of a sample program which covers the entire period of study. The technical complementary courses selected, usually in the last two terms of the program, will depend upon the student's interests. All students must *meet with their advisor* each term to confirm the courses for which they are registered.

Courses taken in Term 3 or later will depend on a student's interests and ability. Information and advice concerning different possibilities are made available in the Department prior to registration. All programs require the approval of a staff advisor. Programs for students transferring into the Department with Advanced Standing will be dependent upon the academic credit previously achieved, and such a program will be established only after consultation with a staff advisor.

9.4.4 Bachelor of Engineering (B.Eng.) - Civil Engineering (139 credits)

Program credit weight: 139 credits

Program credit weight for Quebec CEGEP students: 110 credits

The Civil Engineering program is comprehensive in providing the fundamentals in mechanics and engineering associated with the diverse fields of the profession, in offering choices of specialization, and in fully reflecting the advances in science, mathematics, engineering, and computing that have transformed all fields of engineering in recent years. The resulting knowledge and training enables graduates to not only enter the profession thoroughly well prepared, but also to adapt to further change.

The required courses ensure a sound scientific and analytical basis for professional studies through courses in solid mechanics, fluid mechanics, soil mechanics, environmental engineering, water resources management, structural analysis, systems analysis, and mathematics. Fundamental concepts are applied to various fields of practice in both required and complementary courses.

By a suitable choice of complementary courses, students can attain advanced levels of technical knowledge in the specialized areas mentioned above. Alternatively, students may choose to develop their interests in a more general way by combining complementary courses within the Department with several from other departments or faculties.

Required Year 0 (Freshman) Courses

29 credits

Generally

CIVE 311	(4)	Geotechnical Mechanics
CIVE 317	(3)	Structural Engineering 1
CIVE 318	(3)	Structural Engineering 2
CIVE 319	(3)	Transportation Engineering
CIVE 320	(4)	Numerical Methods
CIVE 323	(3)	Hydrology and Water Resources
CIVE 324	(3)	Sustainable Project Management
CIVE 327	(4)	Fluid Mechanics and Hydraulics
CIVE 418	(4)	Design Project
CIVE 432	(1)	Technical Paper

Complementary Courses

21 credits

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 440	(3)	Traffic Engineering and Simulation
CIVE 462	(3)	Design of Steel Structures
CIVE 463	(3)	Design of Concrete Structures

List B - General Technical Complementaries

0-9 credits from the following, or from other suitable undergraduate or 500-level courses:

CHEE 521*	(3)	Nanomaterials and the Aquatic Environment
CIVE 446	(3)	Construction Engineering
CIVE 460	(3)	Matrix Structural Analysis
CIVE 470	(3)	Undergraduate Research Project
CIVE 507	(3)	Wind Engineering
CIVE 512	(3)	Advanced Civil Engineering Materials
CIVE 520	(3)	Groundwater Hydrology
CIVE 521*	(3)	Nanomaterials and the Aquatic Environment
CIVE 527	(3)	Renovation and Preservation: Infrastructure
CIVE 528	(3)	Design of Wood Structures
CIVE 540	(3)	Urban Transportation Planning
CIVE 542	(3)	Transportation Network Analysis
CIVE 545	(0)	
CIVE 546	(3)	Selected Topics in Civil Engineering 1
CIVE 550	(3)	Water Resources Management
CIVE 555	(3)	Environmental Data Analysis
CIVE 557	(3)	Microbiology for Environmental Engineering

CIVE 560	(3)	Transportation Safety and Design
CIVE 561	(3)	Greenhouse Gas Emissions
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)	Mechanics of Groundwater Flow
URBP 551	(3)	Urban Design and Planning

* Students may choose only one of CHEE 521 or CIVE 521.

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
ECON 225	(3)	Economics of the Environment
ECON 347	(3)	Economics of Climate Change
ENVR 201	(3)	Society, Environment and Sustainability
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
MGPO 440*	(3)	Strategies for Sustainability
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

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

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 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) (excluding courses that principally impart language skills, such as Sanskrit, Tibetan, Tamil, New Testament Greek, and Biblical Hebrew) ***

School of Social Work (SWRK)

Sociology (excluding SOCI 350)

OR one of the following:

All programs provide students with a strong background in mathematics, natural 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.

9.5.3 Bachelor of Engineering (B.Eng.) - Electrical Engineering (134 credits)

Program credit weight: 134-137 credits

Program credit weight for Quebec CEGEP students: 109-112 credits

This program gives students a broad understanding of the key principles that are responsible for the extraordinary advances in the technology of computers, micro-electronics, automation and robotics, telecommunications, and power systems. These areas are critical to the development of our industries and, more generally, to our economy. A graduate of this program is exposed to 67.ram is e

57 credits

ECSE 200	(3)	Electric Circuits 1
ECSE 205	(3)	Probability and Statistics for Engineers
ECSE 206	(3)	Introduction to Signals and Systems
ECSE 210	(3)	Electric Circuits 2
ECSE 211	(3)	Design Principles and Methods
ECSE 222	(3)	Digital Logic
ECSE 250	(3)	Fundamentals of Software Development
ECSE 251	(3)	Electric and Magnetic Fields
ECSE 307	(4)	Linear Systems and Control
ECSE 308	(4)	Introduction to Communication Systems and Networks
ECSE 324	(4)	Computer Organization
ECSE 331	(4)	Electronics
ECSE 343	(3)	Numerical Methods in Engineering
ECSE 354	(4)	Electromagnetic Wave Propagation
ECSE 362	(4)	Fundamentals of Power Engineering
ECSE 458D1	(3)	Capstone Design Project
ECSE 458D2	(3)	Capstone Design Project

Note: ECSE 458N1 and ECSE 458N2 can be taken instead of ECSE 458D1 and ECSE 458D2.

Complementary Courses (23-26 credits)

Technical Complementaries

17-20 credits (5 courses) must be taken, chosen as follows:

8 credits (2 courses) from List A

9-12 credits (3 courses) from List A or List B

List A: Technical Complementaries with Laboratory Experience

8-20 credits

ECSE 335	(4)	Microelectronics
ECSE 403	(4)	Control
ECSE 408	(4)	Communication Systems
ECSE 416	(4)	Telecommunication Networks
ECSE 433	(4)	Physical Basis of Transistor Devices
ECSE 444	(4)	Microprocessors
ECSE 470	(4)	Electromechanical and Static Conversion Systems

List B: Technical Complementaries

0-12 credits

COMP 370	(3)	Introduction to Data Science
COMP 549	(3)	Brain-Inspired Artificial Intelligence
COMP 551^	(4)	Applied Machine Learning
COMP 559	(4)	Fundamentals of Computer Animation
COMP 562	(4)	Theory of Machine Learning

ECSE 310	(3)	Thermodynamics of Computing
ECSE 325	(3)	Digital Systems
ECSE 405	(3)	Antennas
ECSE 412	(3)	Discrete Time Signal Processing
ECSE 415	(3)	Introduction to Computer Vision
ECSE 420	(3)	Parallel Computing
ECSE 421	(3)	Embedded Systems
ECSE 422	(3)	Fault Tolerant Computing
ECSE 423	(3)	Fundamentals of Photonics
ECSE 424	(3)	Human-Computer Interaction
ECSE 425	(3)	Computer Architecture
ECSE 427	(3)	Operating Systems
ECSE 430	(3)	Photonic Devices and Systems
ECSE 435	(3)	Mixed-Signal Test Techniques
ECSE 446	(3)	Realistic Image Synthesis
ECSE 451	(3)	EM Transmission and Radiation
ECSE 460*	(3)	Appareillage électrique (Electrical Power Equipment)
ECSE 463**	(3)	Electric Power Generation
ECSE 464	(3)	Power Systems Analysis
ECSE 465***	(3)	Power Electronic Systems
ECSE 466*	(3)	Réseaux de distribution
ECSE 467*	(3)	Comportement des réseaux électriques
ECSE 468*	(3)	Electricité industrielle (Industrial Power Systems)
ECSE 469*	(3)	Protection des réseaux électriques
ECSE 472	(3)	Fundamentals of Circuit Simulation and Modelling
ECSE 500	(3)	Mathematical Foundations of Systems
ECSE 501	(3)	Linear Systems
ECSE 507	(3)	Optimization and Optimal Control
ECSE 508	(3)	Multi-Agent Systems
ECSE 509	(3)	Probability and Random Signals 2
ECSE 510	(3)	Filtering and Prediction for Stochastic Systems
ECSE 516	(3)	Nonlinear and Hybrid Control Systems
ECSE 519	(3)	Semiconductor Nanostructures and Nanophotonic Devices
ECSE 521	(3)	Digital Communications 1
ECSE 525	(4)	Satellite Navigation Systems
ECSE 526	(3)	Artificial Intelligence
ECSE 532	(4)	Computer Graphics
ECSE 543	(3)	Numerical Methods in Electrical Engineering
ECSE 544	(4)	Computational Photography
ECSE 551^	(4)	Machine Learning for Engineers
ECSE 552	(4)	Deep Learning
ECSE 554	(4)	Applied Robotics
ECSE 556	(4)	Machine Learning in Network Biology

ECSE 557	(3)	Introduction to Ethics of Intelligent Systems
ECSE 562**	(4)	Low-Carbon Power Generation Engineering
ECSE 563	(3)	Power Systems Operation and Planning
ECSE 565***	(3)	Introduction to Power Electronics
ECSE 575	(3)	Heterogeneous Integration Systems
PHYS 346	(3)	Majors Quantum Physics
PHYS 434	(3)	Optics

* Courses taught in French.

** ECSE 463 and ECSE 562 cannot both be taken.

*** ECSE 465 and ECSE 565 cannot both be taken.

^ ECSE 551 and COMP 551 cannot both be taken.

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
ECON 225	(3)	Economics of the Environment

Sociology (excluding SOCI 350)

OR 3 credits from the following:

ARCH 528	(3)	History of Housing
BUSA 465*	(3)	Technological Entrepreneurship
CLAS 203	(3)	Greek Mythology
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
HISP 225	(3)	Hispanic Civilization 1
HISP 226	(3)	Hispanic Civilization 2

- agree to follow the curriculum requirements set out below.

SELECTION CRITERIA

The number of students selected, expected to be between five and ten, will be subject to a specific agreement between the University and the Institute. Selection criteria for admission to the Institute will be based on the CGPA and on the curriculum vitae. The selection process for the scholarship may involve an interview with the committee presided by Hydro-Québec and the industrial partners. There is a possibility of an internship with Hydro-Québec.

CURRICULUM REQUIREMENTS FOR SELECTED STUDENTS

Generally, unless the University has authorized specific substitutions, students must complete the degree requirements set out in this eCalendar with the following specifications:

ECSE 354	(4)	Electromagnetic Wave Propagation
ECSE 362	(4)	Fundamentals of Power Engineering
ECSE 396	(1)	Honours Research Laboratory Rotation 1
ECSE 397	(1)	Honours Research Laboratory Rotation 2
ECSE 478D1	(3)	Electrical Engineering Honours Thesis
ECSE 478D2	(3)	Electrical Engineering Honours Thesis
ECSE 496	(1)	Honours Research Laboratory Rotation 3
ECSE 497	(1)	Honours Research Laboratory Rotation 4

Note: ECSE 478N1 and ECSE 478N2 can be taken instead of ECSE 478D1 and ECSE 478D2.

Complementary Courses (23-26 credits)

Technical Complementaries

17-20 credits (5 courses) must be taken, chosen as follows:

8 credits (2 courses) from List A

6-8 credits (2 courses) from 500-level ECSE courses

3-4 credits (1 course) from List A, List B, List C or from 500-level ECSE courses

List A: Technical Complementaries with Laboratory Experience

8-12 credits from the following:

ECSE 335	(4)	Microelectronics
ECSE 403*	(4)	Control
ECSE 408**	(4)	Communication Systems
ECSE 416	(4)	Telecommunication Networks
ECSE 433	(4)	Physical Basis of Transistor Devices
ECSE 444	(4)	Microprocessors
ECSE 470	(4)	Electromechanical and Static Conversion Systems

* ECSE 403 and ECSE 501 cannot both be taken.

** ECSE 408 and ECSE 511 cannot both be taken.

List B: Technical Complementaries

0-3 credits

ECSE 310	(3)	Thermodynamics of Computing
ECSE 325	(3)	Digital Systems
ECSE 415	(3)	Introduction to Computer Vision
ECSE 420	(3)	Parallel Computing
ECSE 421	(3)	Embedded Systems
ECSE 422	(3)	Fault Tolerant Computing
ECSE 424	(3)	Human-Computer Interaction
ECSE 425	(3)	Computer Architecture
ECSE 427	(3)	Operating Systems
ECSE 435	(3)	Mixed-Signal Test Techniques
ECSE 446	(3)	Realistic Image Synthesis
ECSE 451	(3)	EM Transmission and Radiation

Appareillage électrique (Electrical Po

URBP 201 (3) Planning the 21st Century City

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

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 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) (excluding courses that principally impart language skills, such as Sanskrit, Tibetan, Tamil, New Testament Greek, and Biblical Hebrew) ***

School of Social Work (SWRK)

Sociology (excluding SOCI 350)

OR 3 credits from the following:

ARCH 528	(3)	History of Housing
BUSA 465*	(3)	Technological Entrepreneurship
CLAS 203	(3)	Greek Mythology
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
HISP 225	(3)	Hispanic Civilization 1
HISP 226	(3)	Hispanic Civilization 2
INDR 294*	(3)	Introduction to Labour-Management Relations
INTG 201**	(3)	Integrated Management Essentials 1
INTG 202**	(3)	Integrated Management Essentials 2
MATH 338	(3)	History and Philosophy of Mathematics
MGCR 222*	(3)	Introduction to Organizational Behaviour
MGCR 352*	(3)	Principles of Marketing

Leade

9.5.5 Bachelor of Engineering (B.Eng.) - Computer Engineering (133 credits)

Program credit weight: 133-136 credits

Program credit weight for Quebec CEGEP students: 108-111 credits

Program credit weight for out-of-province students: 133-136 credits

The Computer Engineering program provides students with greater depth and breadth of knowledge in the hardware and software aspects of computers. Students are exposed to both theoretical and practical issues of both hardware and software in well-equipped laboratories. Although the program is designed to meet the growing demands by industry for engineers with a strong background in modern computer technology, it also provides the underlying depth for graduate studies in all fields of Computer Engineering.

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

Required Year 0 (Freshman) Courses

25 credits

Generally, students admitted to Engineering from Quebec CEGEPs are granted transfer credit for these Year 0 (Freshman) courses and enter a 108- to 111 credit 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/current-students/undergraduate/ne>

ECSE 206	(3)	Introduction to Signals and Systems
ECSE 210	(3)	Electric Circuits 2
ECSE 211	(3)	Design Principles and Methods
ECSE 222	(3)	Digital Logic
ECSE 223	(3)	Model-Based Programming
ECSE 250	(3)	Fundamentals of Software Development
ECSE 308	(4)	Introduction to Communication Systems and Networks
ECSE 310	(3)	Thermodynamics of Computing
ECSE 321	(3)	Introduction to Software Engineering
ECSE 324	(4)	Computer Organization
ECSE 325	(3)	Digital Systems
ECSE 331	(4)	Electronics
ECSE 353	(3)	Electromagnetic Fields and Waves
ECSE 425	(3)	Computer Architecture
ECSE 427	(3)	Operating Systems
ECSE 444	(4)	Microprocessors
ECSE 458D1	(3)	Capstone Design Project
ECSE 458D2	(3)	Capstone Design Project

Note: ECSE 458N1 and ECSE 458N2 can be taken instead of ECSE 458D1 and ECSE 458D2.

Complementary Courses

15-18 credits

Technical Complementaries

9-12 credits (3 courses) must be taken, chosen as follows:

3-4 credits (1 course) from List A

6-8credits (2 courses) from List A or List B

List A

3-12 credits from the following:

ECSE 307	(4)	Linear Systems and Control
ECSE 335	(4)	Microelectronics
ECSE 403	(4)	Control
ECSE 408	(4)	Communication Systems
ECSE 412	(3)	Discrete Time Signal Processing
ECSE 415	(3)	Introduction to Computer Vision
ECSE 416	(4)	Telecommunication Networks
ECSE 420	(3)	Parallel Computing
ECSE 428	(3)	Software Engineering Practice
ECSE 435	(3)	Mixed-Signal Test Techniques
ECSE 439	(3)	Software Language Engineering
ECSE 508	(3)	Multi-Agent Systems
ECSE 510	(3)	Filtering and Prediction for Stochastic Systems
ECSE 544	(4)	Computational Photography

List B

0-12 credits from the following:

COMP 307	(3)	Principles of Web Development
COMP 370	(3)	Introduction to Data Science
COMP 421	(3)	Database Systems
COMP 424**	(3)	Artificial Intelligence
COMP 445	(3)	Computational Linguistics
COMP 512	(4)	Distributed Systems
COMP 520	(4)	Compiler Design
COMP 549	(3)	Brain-Inspired Artificial Intelligence
COMP 550	(3)	Natural Language Processing
COMP 551*	(4)	Applied Machine Learning
COMP 559	(4)	Fundamentals of Computer Animation
COMP 562	(4)	Theory of Machine Learning
COMP 579	(4)	Reinforcement Learning
COMP 588	(4)	Probabilistic Graphical Models

** COMP 424 and ECSE 526 cannot both be taken.

Complementary Studies

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
ECON 225	(3)	Economics of the Environment
ECON 347	(3)	Economics of Climate Change
ENVR 201	(3)	Society, Environment and Sustainability
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
MGPO 440*	(3)	Strategies for Sustainability
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

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

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 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) (excluding courses that principally impart language skills, such as Sanskrit, Tibetan, Tamil, New Testament Greek, and Biblical Hebrew) ***

School of Social Work (SWRK)

Sociology (excluding SOCI 350)

OR 3 credits from the following:

ARCH 528	(3)	History of Housing
BUSA 465*	(3)	Technological Entrepreneurship
CLAS 203	(3)	Greek Mythology
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
HISP 225	(3)	Hispanic Civilization 1

HISP 226	(3)	Hispanic Civilization 2
INDR 294*	(3)	Introduction to Labour-Management Relations
INTG 201**	(3)	Integrated Management Essentials 1
INTG 202**	(3)	Integrated Management Essentials 2

Earth and Planetary Sciences (EPSC)

Earth System Science (ESYS)

Physics (PHYS)

Note: FACC 100 (Introduction to the Engineering Profession) must be taken during the first year of study.

Required Non-Departmental Courses

35 credits

COMP 202	(3)	Foundations of Programming
COMP 206	(3)	Introduction to Software Systems
COMP 251	(3)	Algorithms and Data Structures
COMP 302	(3)	Programming Languages and Paradigms
COMP 360	(3)	Algorithm Design
COMP 421	(3)	Database Systems
FACC 100**	(1)	Introduction to the Engineering Profession
FACC 250	(0)	Responsibilities of the Professional Engineer
FACC 300	(3)	Engineering Economy
FACC 400	(1)	Engineering Professional Practice
MATH 240	(3)	Discrete Structures
MATH 262	(3)	Intermediate Calculus
MATH 263	(3)	Ordinary Differential Equations for Engineers
WCOM 206	(3)	Communication in Engineering

* Note: *CCOM 206 must be passed two terms prior to ECSE 201.

** Note: FACC 100 (Introduction to the Engineering Profession) must be taken during the first year of study.

Required Software Engineering Courses

60 credits

ECSE 200	(3)	Electric Circuits 1
ECSE 201	(2)	Co-operative Work Term 1
ECSE 205	(3)	Probability and Statistics for Engineers
ECSE 211	(3)	Design Principles and Methods
ECSE 222	(3)	Digital Logic
ECSE 223	(3)	Model-Based Programming
ECSE 250	(3)	Fundamentals of Software Development
ECSE 301	(2)	Co-operative Work Term 2
ECSE 310	(3)	Thermodynamics of Computing
ECSE 316	(3)	Signals and Networks
ECSE 321	(3)	Introduction to Software Engineering
ECSE 324	(4)	Computer Organization
ECSE 326	(3)	Software Requirements Engineering
ECSE 401	(2)	Co-operative Work Term 3
ECSE 402	(2)	Co-operative Work Term 4
ECSE 420	(3)	Parallel Computing
ECSE 427	(3)	Operating Systems
ECSE 428	(3)	Software Engineering Practice

ECSE 429	(3)	Software Validation
ECSE 458D1	(3)	Capstone Design Project
ECSE 458D2	(3)	Capstone Design Project

Note: ECSE 458N1 and ECSE 458N2 can be taken instead of ECSE 458D1 and ECSE 458D2.

Complementary Courses

15-18 credits

Technical Complementaries

9-12 credits (3 courses) must be taken, chosen as follows:

3-4 credits (1 course) from List A

6-8 credits (2 courses) from List A or List B

* COMP 350 and ECSE 343 cannot both be taken

** ECSE 551 and COMP 551 cannot both be taken

*** COMP 424 and ECSE 526 cannot both be taken

List A

3-12 credits from the following:

ECSE 325	(3)	Digital Systems
ECSE 415	(3)	Introduction to Computer Vision
	(4)	Telecommunication Networks

COMP 559	(4)	Fundamentals of Computer Animation
COMP 562	(4)	Theory of Machine Learning
COMP 588	(4)	Probabilistic Graphical Models
ECSE 343*	(3)	Numerical Methods in Engineering
ECSE 421	(3)	Embedded Systems
ECSE 422	(3)	Fault Tolerant Computing
ECSE 424	(3)	Human-Computer Interaction
ECSE 425	(3)	Computer Architecture
ECSE 437	(3)	Software Delivery
ECSE 446	(3)	Realistic Image Synthesis
ECSE 507	(3)	Optimization and Optimal Control
ECSE 509	(3)	Probability and Random Signals 2
ECSE 525	(4)	Satellite Navigation Systems
ECSE 526***	(3)	Artificial Intelligence
ECSE 532	(4)	Computer Graphics
ECSE 551**	(4)	Machine Learning for Engineers
ECSE 552	(4)	Deep Learning
ECSE 554	(4)	Applied Robotics
ECSE 556	(4)	Machine Learning in Network Biology
ECSE 557	(3)	Introduction to Ethics of Intelligent Systems
ECSE 561	(3)	Automated Program Analysis and Testing
MATH 247	(3)	Honours Applied Linear Algebra

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
ECON 225	(3)	Economics of the Environment
ECON 347	(3)	Economics of Climate Change
ENVR 201	(3)	Society, Environment and Sustainability
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
MGPO 440*	(3)	Strategies for Sustainability
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

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

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 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) (excluding courses that principally impart language skills, such as Sanskrit, Tibetan, Tamil, New T

9.6 Global Engineering

The newly created Bachelor of Global Engineering is a joint undergraduate program between CentraleSupélec and McGill University's Faculty of Engineering.

Over the course of four years, an international cohort will study an intensive and multidisciplinary engineering curriculum taught in English within a French-speaking culture. Students spend two years at CentraleSupélec, where they follow a common curriculum and benefit from the French excellence in mathematics and science within a Grande École. They then spend two years at McGill, specializing in one of the 9 streams offered as part of the program. This new joint program aims at tackling the challenges of the modern world: environmental, societal, and corporate challenges. The curriculum mixes the best of the two systems, develops scientific excellence and best practices for global engineering (in both the multicultural and multidisciplinary sense).

Beyond the strong curriculum, students will enjoy two very different campuses. CentraleSupélec is just 20km away from Paris, in the heart of the "French Silicon Valley," and the campus hosts numerous sport facilities and student clubs. McGill is in heart of downtown Montreal, one of the most multicultural and vibrant cities in the world.

Upon graduation, students will have the opportunity to join industry, in a broad spectrum of capacities (by working for consulting or engineering firms, or as an entrepreneur), or to continue their studies at the master's level in France, Canada, or any other top university.

For further information, please refer to CentraleSupélec's page for the [Bachelor of Global Engineering](#).

9.6.1 Bachelor of Global Engineering (BGE) - Global Engineering (127 credits)

Program credit weight: 120-127 credits

The Bachelor of Global Engineering is designed to provide a combination of hard, technical skills in science and engineering, combined with soft, non-technical skills in the humanities, business/management, and languages. The program focuses on: 1) a strong foundation in mathematics, and all three principal scientific disciplines (physics, chemistry and biology), and 2) specialized engineering training in one of nine streams (Breadth, Biological, Chemical, Civil, Data Science, Electrical, Entrepreneurship, Materials and Mechanical). Moreover, the program is offered, by design, in an international setting (two years at CentraleSupélec in France, and two years at McGill University in Canada), to provide training in the solution of complex scientific/engineering problems that can be undertaken in interdisciplinary teams, in global settings.

Required Year 0 and Year 1 Courses

60 credits (120 ECTS credits)

Years 0 and 1 of the program take place at CentraleSupélec, in France, and the required Year 0 and Year 1 courses will be taken there. All remaining courses will be taken at McGill University in Canada.

HSS122 Topics in International Sustainable Development 2 (1 ECTS)
HSS211 Perspectives of Modern Geopolitics 1 (1 ECTS)
HSS212 Perspectives of Modern Geopolitics 2 (1 ECTS)
HSS221 Structure of Corporations 1 (1 ECTS)
HSS222 Structure of Corporations 2 (1 ECTS)
INTERN121 Internship - Social Impact (1 ECTS)
INTERN221 Internship - Company Discovery (1 ECTS)
MAA111 Analysis 1 (3.5 ECTS)
MAA112 Analysis 2 (3.5 ECTS)
MAA121 Analysis 3 (3.5 ECTS)
MAA122 Probability (3.5 ECTS)
MAA211 Linear Algebra (4 ECTS)
MAA212 Topology and Functional Analysis (4 ECTS)
MAA221 Numerical Analysis (3 ECTS)
MAA222 Continuous Probability and Introduction to Statistical Modelling (3 ECTS)
ML111 Modern Languages 1 (1 ECTS)
ML112 Modern Languages 2 (1 ECTS)
ML121 Modern Languages 3 (1 ECTS)
ML122 Modern Languages 4 (1 ECTS)
ML211 Modern Languages 5 (1 ECTS)
ML212 Modern Languages 6 (1 ECTS)
ML221 Modern Languages 7 (1 ECTS)
ML222 Modern Languages 8 (1 ECTS)
MOD111 Introduction to Modelling (3 ECTS)
MOD211 Data and Modelling Week (3 ECTS)
PHY111 Mechanics (3 ECTS)
PHY112 Electric Circuits (3 ECTS)
PHY121 Thermodynamics (2.5 ECTS)
PHY122 Physics of Waves (2.5 ECTS)
PHY211 Electromagnetism and Conduction (3 ECTS)
PHY212 Electromagnetism and Waves (3 ECTS)
PHY221 Waves and Optics (3 ECTS)
PM121 Project Management 1 (1 ECTS)
PM122 Project Management 2 (1 ECTS)
PRO121 Project - Sustainable Development (1 ECTS)
PRO221 Project- Research (4 ECTS)

Year 2 and Year 3 Courses

60-67 credits

Years 2 and 3 of the program take place at McGill University, in Canada, and the Year 2 and Year 3 courses will be taken there.

Required Non-Departmental Courses

9 credits

INTG 201	(3)	Integrated Management Essentials 1
INTG 202	(3)	Integrated Management Essentials 2
WCOM 206	(3)	Communication in Engineering

Required Faculty of Engineering Courses

4 credits

FACC 200 (0) Industrial Practicum 1

6-7 credits

SEAD 500	(3)	Foundations of Sustainability for Engineering and Design
SEAD 510	(4)	Energy Analysis
SEAD 515	(3)	Climate Change Adaptation and Engineering Infrastructure
SEAD 550	(3)	Decision-Making for Sustainability in Engineering and Design

Stream 2: Biological

38-39 credits (13 courses) must be taken, chosen as follows:

32 credits (11 courses) from List A

6-7 credits (2 courses) from List B

BREE 522	(3)	Bio-Based Polymers
CHEE 370	(3)	Elements of Biotechnology
CHEE 563*	(3)	Biofluids and Cardiovascular Mechanics
MECH 547	(3)	Mechanics of Biological Materials
MECH 563*	(3)	Biofluids and Cardiovascular Mechanics
PHYS 534	(3)	Nanoscience and Nanotechnology

*Students select either CHEE 563 or MECH 563

Stream 3: Chemical

41 credits

CHEE 200	(3)	Chemical Engineering Principles 1
CHEE 204	(3)	Chemical Engineering Principles 2
CHEE 291	(4)	Instrumentation and Measurement 1
CHEE 314	(3)	Fluid Mechanics
CHEE 315	(3)	Heat and Mass Transfer
CHEE 351	(3)	Separation Processes
CHEE 380	(3)	Materials Science
CHEE 390	(3)	Computational Methods in Chemical Engineering
CHEE 423	(3)	Chemical Reaction Engineering
CHEE 453	(4)	Process Design
CHEM 234	(3)	Topics in Organic Chemistry
FACC 463D1	(3)	Engineering Design Project
FACC 463D2	(3)	Engineering Design Project

Stream 4: Civil

45 credits (13 courses) must be taken, chosen as follows:

39 credits (11 courses) from List A

6 credits (2 courses) from List B

List A: Civil Stream Core

39 credits

CIVE 202	(4)	Construction Materials
CIVE 207	(4)	Solid Mechanics
CIVE 225	(4)	Environmental Engineering
CIVE 311	(4)	Geotechnical Mechanics
CIVE 317	(3)	Structural Engineering 1
CIVE 319	(3)	Transportation Engineering
CIVE 320	(4)	Numerical Methods
CIVE 327	(4)	Fluid Mechanics and Hydraulics
FACC 463D1	(3)	Engineering Design Project
FACC 463D2	(3)	Engineering Design Project
MECH 289	(3)	Design Graphics

List B: Civil Stream Technical Complementarys

6 credits

CIVE 206	(3)	Dynamics
CIVE 302	(3)	Probabilistic Systems
CIVE 318	(3)	Structural Engineering 2
CIVE 416	(3)	Geotechnical Engineering

Stream 5: Data Science

39-40 credits

COMP 251	(3)	Algorithms and Data Structures
COMP 302	(3)	Programming Languages and Paradigms
COMP 360	(3)	Algorithm Design
COMP 421	(3)	Database Systems
COMP 551*	(4)	Applied Machine Learning
ECSE 223	(3)	Model-Based Programming
ECSE 321	(3)	Introduction to Software Engineering
ECSE 343	(3)	Numerical Methods in Engineering
ECSE 458D1	(3)	Capstone Design Project
ECSE 458D2	(3)	Capstone Design Project
ECSE 507**	(3)	Optimization and Optimal Control
ECSE 509	(3)	Probability and Random Signals 2
ECSE 526*	(3)	Artificial Intelligence
ECSE 551*	(4)	Machine Learning for Engineers
MATH 240	(3)	Discrete Structures
MECH 559**	(3)	Engineering Systems Optimization
MECH 579**	(3)	Multidisciplinary Design Optimization

*Students select one of COMP 551, ECSE 526 or ECSE 551

**Students select one of ECSE507, MECH 559 or MECH 579

Stream 6: Electrical

43 credits (13 courses) must be taken, chosen as follows:

37 credits (11 courses) from List A

6 credits (2 courses) from List B

List A: Electrical Stream Core

37 credits

ECSE 206	(3)	Introduction to Signals and Systems
ECSE 210	(3)	Electric Circuits 2
ECSE 222	(3)	Digital Logic
ECSE 307	(4)	Linear Systems and Control
ECSE 308	(4)	Introduction to Communication Systems and Networks
ECSE 324	(4)	Computer Organization
ECSE 331	(4)	Electronics

ECSE 343	(3)	Numerical Methods in Engineering
ECSE 353	(3)	Electromagnetic Fields and Waves
ECSE 458D1	(3)	Capstone Design Project
ECSE 458D2	(3)	Capstone Design Project

List B: Electrical Stream Technical Complementaries

6 credits

COMP 417	(3)	Introduction Robotics and Intelligent Systems
ECSE 211	(3)	Design Principles and Methods
MECH 412	(3)	System Dynamics and Control
MECH 572	(3)	Mechanics and Control of Robotic Manipulators
MECH 573	(3)	Mechanics of Robotic Systems
MIME 262	(3)	Properties of Materials in Electrical Engineering

Stream 7: Entrepreneurship

43 credits (13 courses) must be taken, chosen as follows:

40 credits (12 courses) from List A

3 credits (1 courses) from List B

List A: Entrepreneurship Stream Core

40 credits

BIEN 310	(3)	Introduction to Biomolecular Engineering
CHEE 231	(3)	Data Analysis and Design of Experiments
CIVE 207	(4)	Solid Mechanics
ECSE 206	(3)	Introduction to Signals and Systems
ECSE 308	(4)	Introduction to Communication Systems and Networks
FACC 500	(3)	Technology Business Plan Design
FACC 501	(3)	Technology Business Plan Project
MECH 220	(4)	Mechanics 2
MECH 309	(3)	Numerical Methods in Mechanical Engineering
MGPO 362	(3)	Fundamentals of Entrepreneurship
MIME 260*	(3)	Materials Science and Engineering
MIME 261*	(3)	Structure of Materials
MIME 356	(4)	Heat, Mass and Fluid Flow

*Students select either MIME 260 or MIME 261

List B: Entrepreneurship Stream Technical Complementaries

3 credits

BUSA 465	(3)	Technological Entrepreneurship
LAWG 570	(3)	Innovation for Non-Law Students
MGPO 364	(3)	Entrepreneurship in Practice
MGPO 438	(3)	Social Entrepreneurship and Innovation
ORGB 321*	(3)	Leadership

Stream 8: Materials

43 credits (14 courses) must be taken, chosen as follows:

37 credits (12 courses) from List A

6 credits (2 courses) from List B

List A: Materials Stream Core

37 credits

FACC 463D1	(3)	Engineering Design Project
FACC 463D2	(3)	Engineering Design Project
MECH 290	(3)	Design Graphics for Mechanical Engineering
MIME 261	(3)	Structure of Materials
MIME 317	(3)	Analytical and Characterization Techniques
MIME 345	(3)	Applications of Polymers
MIME 350	(3)	Extractive Metallurgical Engineering
MIME 352	(3)	Hydrochemical Processing
MIME 356	(4)	Heat, Mass and Fluid Flow
MIME 360	(3)	Phase Transformations: Solids
MIME 362	(3)	Mechanical Properties
MIME 473	(3)	Introduction to Computational Materials Design

List B: Materials Stream Technical Complementaries

6 credits

MIME 311	(3)	Modelling and Automatic Control
MIME 455	(3)	Advanced Process Engineering
MIME 465	(3)	Metallic and Ceramic Powders Processing
MIME 467	(3)	Electronic Properties of Materials
MIME 470	(3)	Engineering Biomaterials

Stream 9: Mechanical

41-43 credits (13 courses) must be taken, chosen as follows:

35 credits (11 courses) from List A

6-8 credits (2 courses) from List B

List A: Mechanical Stream Core

35 credits

CIVE 207	(4)	Solid Mechanics
ECSes)0	(3)	Introduction to Signals and Systems

MECH 463D2	(3)	Design 3: Mechanical Engineering Project
MIME 260	(3)	Materials Science and Engineering

List B: Mechanical Stream Technical Complementaries

6-8 credits

COMP 417	(3)	Introduction Robotics and Intelligent Systems
ECSE 307	(4)	Linear Systems and Control
ECSE 461	(3)	Electric Machinery
MECH 314	(3)	Dynamics of Mechanisms
MECH 315	(4)	Mechanics 3
MECH 321	(3)	Mechanics of Deformable Solids
MECH 341	(3)	Thermodynamics 2
MECH 346	(3)	Heat Transfer
MECH 360	(3)	Principles of Manufacturing
MECH 383	(3)	Applied Electronics and Instrumentation
MECH 393	(3)	Design 2: Machine Element Design
MECH 412	(3)	System Dynamics and Control
MECH 572	(3)	Mechanics and Control of Robotic Manipulators
MECH 573	(3)	Mechanics of Robotic Systems

Complementary Studies

9 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
CIVE 469	(0)	
ECON 225	(3)	Economics of the Environment
ECON 347	(3)	Economics of Climate Change
ENVR 201	(3)	Society, Environment and Sustainability
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
MGPO 440*	(3)	Strategies for Sustainability
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

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

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

6 credits at the 200 level or higher from the following departments:

Anthropology (ANTH)

Economics (any 200- or 300-level course excluding 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) Religious Studies (RELG) (excluding courses that principally impart language skills, such as Sanskrit, Tibetan, Tamil, New Testament Greek, and Biblical Hebrew)**

School of Social Work (SWRK)

Sociology (excluding SOCI 350)

OR from the following courses:

ARCH 528	(3)	History of Housing
BUSA 465*	(3)	Technological Entrepreneurship
CLAS 203	(3)	Greek Mythology
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
HISP 225	(3)	Hispanic Civilization 1
HISP 226	(3)	Hispanic Civilization 2
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)	Principles of Marketing
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>.

**If you are uncertain whether or not a course principally imparts language skills, please see an adviser in the McGill Engineering Student Centre (Frank Dawson Adams Building, Room 22) or email an adviser.

Note regarding language courses: Language courses are not accepted to satisfy the Complementary Studies Group B requirement.

9.7 Mechanical Engineering

9.7.1 Location

Macdonald Engineering Building, Room 270
817 Sherbrooke Street West
Montreal QC H3A 0C3
Telephone: 514-398-6296
Fax: 514-398-7365
Email: ugrad.mec

F

(1)

Introduction to the Engineering Profession

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 530	(3)	Mechanics of Composite Materials
MECH 532	(3)	Aircraft Performance, Stability and Control
MECH 535	(3)	Turbomachinery and Propulsion
MECH 536	(3)	Aerospace Structures
MECH 543	(3)	Design with Composite Materials
MECH 544	(3)	Processing of Composite Materials
MECH 553	(3)	Design and Manufacture of Microdevices
MECH 559	(3)	Engineering Systems Optimization
MECH 560	(3)	Eco-design and Product Life Cycle Assessment
MECH 563*	(3)	Biofluids and Cardiovascular Mechanics
MECH 564	(3)	Thermal Radiation and Solar Energy Systems
MECH 565	(3)	Fluid Flow and Heat Transfer Equipment
MECH 573	(3)	Mechanics of Robotic Systems

* Students select either CHEE 563 or MECH 563.

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

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
ECON 225	(3)	Economics of the Environment
ECON 347	(3)	Economics of Climate Change
ENVR 201	(3)	Society, Environment and Sustainability
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
MGPO 440*	(3)	Strategies for Sustainability
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

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

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 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) (excluding courses that principally impart language skills, such as Sanskrit, Tibetan, Tamil, New Testament Greek, and Biblical Hebrew) ***

School of Social Work (SWRK)

Sociology (excluding SOCI 350)

OR one of the following:

ARCH 528	(3)	History of Housing
BUSA 465*	(3)	Technological Entrepreneurship
CLAS 203	(3)	Greek Mythology
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
HISP 225	(3)	Hispanic Civilization 1
HISP 226	(3)	Hispanic Civilization 2
INDR 294*	(3)	Introduction to Labour-Management Relations
INTG 201**	(3)	Integrated Management Essentials 1
INTG 202**	(3)	Integrated Management Essentials 2
MATH 338	(3)	History and Philosophy of Mathematics
MGCR 222*	(3)	Introduction to Organizational Behaviour
MGCR 352*	(3)	Principles of Marketing
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>.

** Note: INTG 201 and INTG 202 are not open to students who have taken certain Management courses. Please see the INTG 201 and INTG 202 course information for a list of these courses.

*** If you are uncertain whether or not a course principally imparts language skills, please see an adviser in the McGill Engineering Student Centre (Frank Dawson Adams Building, Room 22) or email an adviser.

Note regarding language courses: Language courses are not accepted to satisfy the Complementary Studies Group B requirement, effective for students who entered the program as of Fall 2017.

Typical Program of Study

Students entering the program from CEGEP follow a different course of study from 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 McGill Engineering Student Centre (Student Affairs Office) (Frank Dawson Adams Building, Room 22) or from the Undergraduate Program Coordinator, indicating their intention to take the minor or concentration.

9.7.4 Bachelor of Engineering (B.Eng.) - Honours Mechanical Engineering (142 credits)

Program credit weight: 142 credits

Program credit weight for Quebec CEGEP students: 113 credits

Program credit weight for out-of-province students: 142 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

MECH 201	(2)	Introduction to Mechanical Engineering
MECH 210	(2)	Mechanics 1
MECH 220	(4)	Mechanics 2
MECH 240	(3)	Thermodynamics 1
MECH 262	(3)	Statistics and Measurement Laboratory
MECH 290	(3)	Design Graphics for Mechanical Engineering
MECH 292	(3)	Design 1: Conceptual Design
MECH 309	(3)	Numerical Methods in Mechanical Engineering
MECH 321	(3)	Mechanics of Deformable Solids
MECH 331	(3)	Fluid Mechanics 1
MECH 341	(3)	Thermodynamics 2
MECH 346	(3)	Heat Transfer
MECH 360	(3)	Principles of Manufacturing
MECH 362	(2)	Mechanical Laboratory 1
MECH 383	(3)	Applied Electronics and Instrumentation
MECH 403D1	(3)	Thesis (Honours)
MECH 403D2	(3)	Thesis (Honours)
MECH 404	(3)	Honours Thesis 2
MECH 419	(4)	Advanced Mechanics of Systems
MECH 430	(3)	Fluid Mechanics 2
MECH 494	(3)	Honours Design Project

Technical Complementary Courses

18 credits

3 credits from the following, chosen with the approval of either the thesis supervisor or the coordinator of the Honours program, when a thesis supervisor has not yet been secured:

MATH 316	(3)	Complex Variables
MATH 323	(3)	Probability
MATH 326	(3)	Nonlinear Dynamics and Chaos
MATH 327	(3)	Matrix Numerical Analysis
MATH 417	(3)	Linear Optimization
MATH 478	(3)	Computational Methods in Applied Mathematics

6 credits from the following:

MECH 513	(3)	Control Systems
MECH 546	(3)	Finite Element Methods in Solid Mechanics
MECH 559*	(3)	Engineering Systems Optimization
MECH 562	(3)	Advanced Fluid Mechanics
MECH 578	(3)	Advanced Thermodynamics
MECH 579*	(3)	Multidisciplinary Design Optimization

*Note: Students select either MECH 559 or MECH 579.

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 530	(3)	Mechanics of Composite Materials

URBP 201

(3)

Planning the 21st Century City

* Note: Management courses ha

<http://www.mcgill.ca/mecheng/undergrad/curriculum>.

For all minors and concentrations, students should complete a Course Authorization Form, available from the McGill Engineering Student Centre (Student Affairs Office) (Frank Dawson Adams Building, Room 22) or from the Undergraduate Program Coordinator, indicating their intention to take the minor or concentration.

Bachelor of Engineering (B.Eng.) - Mec

The program is fully accredited by the Canadian Engineering Accreditation Board (CEAB) and is designed to offer students exceptional training for employment in the field.

The core courses are supplemented by complementary courses, which provide a diverse selection of specialties for the graduating engineer. The course structure is reinforced with laboratory exercises. Graduates find employment in a wide range of industries, including the resource and manufacturing sectors. Students in the Co-op program benefit from practical learning experience gained from work-term employment in meaningful engineering jobs, as well as non-tangible learning experiences arising from the responsibilities required to obtain and successfully complete the work terms.

Regarding the Co-op **program fees**, an amount of \$258.05 will be billed during ten consecutive terms for a total amount of \$2,580.50 before graduation. These fees cover expenses directly related to the operation of the Co-op program. Students must register for each of their industrial training courses within the university registration period for returning students or late fees will apply. Before registering for any work term course, students must contact the Co-op in Materials Engineering Liaison Officer for approval.

9.8.3.2 Student Advising

Students entering this program must plan their schedule of studies in consultation with one of the departmental advisors. Appointments may be obtained by contacting the Administrative and Student Affairs Coordinator.

For more information, please refer to the [Academic Advising](#) section of our website.

9.8.3.3 Bachelor of Engineering (B.Eng.) - Materials Engineering (148 credits)

Program credit weight: 148 credits

Program credit weight for Quebec CEGEP students: 119 credits

Students wanting to study Materials Engineering may only be admitted into the B.Eng.; Co-op in Materials Engineering program. There is no direct admission to the B.Eng.; Materials Engineering program (which does not include the work terms required for the Co-op program). Students can transfer from the B.Eng.; Co-op in Materials Engineering to the B.Eng.; Materials Engineering program once they have met certain requirements and obtained approval from the departmental adviser.

The department offers a Major in Materials Engineering leading to an accredited B.Eng. degree in Materials Engineering. Materials are used to enact every human technology and have shaped key eras in history. Major in Materials Engineering students will have the opportunity to learn the fundamental science and engineering of materials through the materials processing pipeline, including how to enrich mineral-poor ore, how to process the materials into the desired microstructures and compositions, and how to use these materials in various applications (aerospace, electronics, and biological systems). With the choice of technical complementary courses, students have an opportunity to specialize and strengthen key materials technologies or broaden their horizons and take courses from several interdisciplinary areas.

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

Required Year 0 (Freshman) Courses

29 credits

Generally, students admitted to Engineering from Quebec CEGEPs are granted transfer credit for these Year 0 (Freshman) courses and enter a 119-credit 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/current-students/undergraduate/new-students> and select your term of admission.

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

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).

Note: FACC 100 (Introduction to the Engineering Profession) must be taken during the first year of study.

Required Non-Departmental Courses

36 credits

CHEM 233	(3)	Topics in Physical Chemistry
CIVE 205	(3)	Statics

CIVE 207	(4)	Solid Mechanics
COMP 208	(3)	Computer Programming for Physical Sciences and Engineering
ECSE 209	(3)	Electrotechnology
FACC 100*	(1)	Introduction to the Engineering Profession
FACC 250	(0)	Responsibilities of the Professional Engineer
FACC 300	(3)	Engineering Economy
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
WCOM 206	(3)	Communication in Engineering

* Note: FACC 100 (Introduction to the Engineering Profession) must be taken during the first year of study.

Required Materials Engineering Courses

59 credits

MIME 209	(3)	Mathematical Applications
MIME 212	(3)	Engineering Thermodynamics
MIME 250	(3)	Introduction to Extractive Metallurgy
MIME 261	(3)	Structure of Materials
MIME 311	(3)	Modelling and Automatic Control
MIME 317	(3)	Analytical and Characterization Techniques
MIME 341	(3)	Introduction to Mineral Processing
MIME 345	(3)	Applications of Polymers
		Extractiv

MECH 530	(3)	Mechanics of Composite Materials
MIME 410	(3)	Materials Research Project
MIME 442	(3)	Analysis, Modelling and Optimization in Mineral Processing
MIME 456	(3)	Steelmaking and Steel Processing
MIME 512	(3)	Corrosion and Degradation of Materials
MIME 515*	(3)	(Bio)material Surface Analysis and Modification
MIME 526	(3)	Mineral Economics

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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

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

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 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) (excluding courses that principally impart language skills, such as Sanskrit, Tibetan, Tamil, New Testament Greek, and Biblical Hebrew) ***

School of Social Work (SWRK)

Sociology (excluding SOCI 350)

OR 3 credits from the following:

ARCH 528	(3)	History of Housing
BUSA 465*	(3)	Technological Entrepreneurship
CLAS 203	(3)	Greek Mythology
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
HISP 225	(3)	Hispanic Civilization 1
HISP 226	(3)	Hispanic Civilization 2
INDR 294*	(3)	Introduction to Labour-Management Relations
INTG 201**	(3)	Integrated Management Essentials 1
INTG 202**	(3)	Integrated Management Essentials 2
MATH 338	(3)	History and Philosophy of Mathematics
	(3)	Introduction to Organizational Behaviour

9.8.3.4 Bachelor of Engineering (B.Eng.) - Co-op in Materials Engineering (148 credits)

Program credit weight: 148 credits

Program credit weight for Quebec CEGEP students: 119 credits

The Department offers a Co-op in Materials Engineering program leading to an accredited B.Eng. degree in Materials Engineering. Materials are used to enact every human technology and have shaped key areas of history. In the Co-op in Materials Engineering, students will have the opportunity to learn the fundamental science and engineering of materials and complete three work-term semesters. The program spans the materials processing pipeline, teaching students how to enrich mineral-poor ore, then to process the materials into the desired microstructures and compositions and finally how to use these materials in various applications (aerospace, electronics and biological systems). With the choice of technical complementary courses, students have an opportunity to specialize and strengthen key materials technologies or broaden their horizons and take courses from several interdisciplinary areas.

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

Required Year 0 (Freshman) Courses

29 credits

Generally, students admitted to Engineering from Quebec CEGEPs are granted transfer credit for these Y

Required Materials Engineering Courses

65 credits

MIME 209	(3)	Mathematical Applications
MIME 212	(3)	Engineering Thermodynamics
MIME 250	(3)	Introduction to Extractive Metallurgy
MIME 261	(3)	Structure of Materials
MIME 280	(2)	Industrial Training 1
MIME 311	(3)	Modelling and Automatic Control
MIME 317	(3)	Analytical and Characterization Techniques
MIME 341	(3)	Introduction to Mineral Processing
MIME 345	(3)	Applications of Polymers
MIME 350	(3)	Extractive Metallurgical Engineering
MIME 352	(3)	Hydrochemical Processing
MIME 356	(4)	Heat, Mass and Fluid Flow
MIME 360	(3)	Phase Transformations: Solids
MIME 362	(3)	Mechanical Properties
MIME 380	(2)	Industrial Training 2
MIME 452	(4)	Process and Materials Design
MIME 455	(3)	Advanced Process Engineering
MIME 465	(3)	Metallic and Ceramic Powders Processing
MIME 467	(3)	Electronic Properties of Materials
MIME 470	(3)	Engineering Biomaterials
MIME 473	(3)	Introduction to Computational Materials Design
MIME 480	(2)	Industrial Training 3

Complementary Courses

15 credits

Technical Complementaries

12 credits

9-12 credits from the following:

CHEE 515*	(3)	Interface Design: Biomimetic Approach
CIVE 512	(3)	Advanced Civil Engineering Materials
MECH 530	(3)	Mechanics of Composite Materials
MIME 410	(3)	Materials Research Project
MIME 442	(3)	Analysis, Modelling and Optimization in Mineral Processing
MIME 456	(3)	Steelmaking and Steel Processing
MIME 512	(3)	Corrosion and Degradation of Materials
MIME 515*	(3)	(Bio)material Surface Analysis and Modification
MIME 526	(3)	Mineral Economics
MIME 542	(3)	Transmission Electron Microscopy
MIME 544	(3)	Analysis: Mineral Processing Systems 1
MIME 545	(3)	Analysis: Mineral Processing Systems 2

MIME 551	(3)	Electrochemical Processing
MIME 553	(3)	Impact of Materials Production
MIME 556	(3)	Sustainable Materials Processing
MIME 558	(3)	Engineering Nanomaterials
MIME 559	(3)	Aluminum Physical Metallurgy
MIME 560	(3)	Joining Processes
MIME 561	(3)	Advanced Materials Design
MIME 563	(3)	Hot Deformation of Metals
MIME 565	(3)	Aerospace Metallic-Materials and Manufacturing Processes
MIME 568	(3)	Topics in Advanced Materials
MIME 569	(3)	Electron Beam Analysis of Materials
MIME 570	(3)	Micro- and Nano-Fabrication Fundamentals
MIME 571	(3)	Surface Engineering
MIME 572	(3)	Computational Thermodynamics
MIME 580	(3)	Additive Manufacturing Using Metallic and Ceramic Materials

* Students choose either CHEE 515 or MIME 515, offered in alternate years.

0-3 credits may be taken from courses outside of the Department of Mining and Materials Engineering, with departmental approval.

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
ECON 225	(3)	Economics of the Environment
ECON 347	(3)	Economics of Climate Change
ENVR 201	(3)	Society, Environment and Sustainability
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
MGPO 440*	(3)	Strategies for Sustainability
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

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

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 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) (excluding courses that principally impart language skills, such as Sanskrit, Tibetan, Tamil, New Testament Greek, and Biblical

A wide range of scholarships are available to new and continuing students from the Department, Faculty of Engineering, as well as from industry. The Department provides financial support to students who are willing to participate in mining competitions, such as the Canadian Mining Games and World Mining Competition.

When taking a co-op work term, students must register for MIME 290, MIME 291, and MIME 392; thus, co-op work terms appear on the student transcript. Interested students may also take a fourth work term as a complementary course and a fifth one as an extra course.

9.8.4.2 Student Advising

The Department gives priority to their academic advising service. Each student in the mining engineering program is assigned an academic advisor at the start of their study at McGill and for the duration of their undergraduate degree. Our academic advising service ensures quality and individual guidance to each student in the program. Students will meet with their advisor at least once a year to discuss their progress and interest in exchange with other mining schools or taking a minor in their areas of interest among other things.

For more information, please refer to the [Academic Advising](#) section of our website.

9.8.4.3 Bachelor of Engineering (B.Eng.) - Mining Engineering (144 credits)

Enrolment in this program is subject to departmental approval, please consult with an Academic Advisor within the appropriate program further to discuss your suitability in this program.

The Department offers a Major in Mining Engineering Program leading to an accredited B.Eng. degree in Mining Engineering. The program focuses on the science and engineering of sustainable extraction of mineral resources. It contains two streams: English for non-CEGEP students and Bilingual (six courses in French) for CEGEP students, in collaboration with the mining engineering program at Polytechnique Montreal. The program includes projects that are reinforced by field trips to industrial operations.

B.Eng.; Major in Mining Engineering

Program credit weight: 144-145 credits

Program credit weight for CEGEP students: 115-116 credits

Entry into the Major in Mining Engineering

Students in Mining can be admitted only into the B.Eng.; Co-op in Mining Engineering. There is no direct entry to the Major in Mining Engineering (which does not include the work terms required for the Co-op program).

Students may enter the Major in Mining Engineering if they wish at any point in time during their study.

To transfer into the Major program, students must obtain approval from the department adviser and submit a Request for Course Authorization form to the McGill Engineering Student Centre (Frank Dawson Adams, Room 22).

Required Year 0 (Freshman) Courses

29 credits

Generally, students admitted to Engineering from Quebec CEGEPs are granted transfer credit for these Year 0 (Freshman) courses and enter a 115- to 116-credit program.

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

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).

Note: FACC 100 (Introduction to the Engineering Profession) must be taken during the first year of study.

Required Non-Departmental Courses (37 credits)

CIVE 205	(3)	Statics
CIVE 207	(4)	Solid Mechanics
COMP 208*	(3)	Computer Programming for Physical Sciences and Engineering

ECSE 209	(3)	Electrotechnology
EPSC 221	(3)	General Geology
EPSC 225	(1)	Properties of Minerals
FACC 100**	(1)	Introduction to the Engineering Profession
FACC 250	(0)	Responsibilities of the Professional Engineer
FACC 300	(3)	Engineering Economy
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
WCOM 206	(3)	Communication in Engineering

* Note: Students choose either COMP 208 or COMP 250.

** Note: FACC 100 (Introduction to the Engineering Profession) must be taken during the first year of study.

Required Mining Engineering Courses (47 credits)

MIME 200	(3)	Introduction to the Minerals Industry
MIME 203	(2)	Mine Surveying
MIME 209	(3)	Mathematical Applications
MIME 260	(3)	Materials Science and Engineering
MIME 322	(3)	Fragmentation and Comminution
MIME 323	(3)	Rock and Soil Mass Characterization
MIME 325	(3)	Mineral Industry Economics
MIME 333	(3)	Materials Handling
MIME 340	(3)	Applied Fluid Dynamics
MIME 341	(3)	Introduction to Mineral Processing
MIME 413	(3)	Strategic Mine Planning With Uncertainty
MIME 419	(3)	Surface Mining
MIME 422	(3)	Mine Ventilation
MIME 425	(3)	Applied Stochastic Orebody Modelling
MIME 426	(6)	Mine Design and Prefeasibility Study

Complementary Courses

31-32 credits

17 credits from one of Stream A or Stream B

Stream A - CEGEP Students

CEGEP students must take the following courses:

MPMC 321*	(3)	Mécanique des roches et contrôle des terrains
MPMC 326*	(3)	Recherche opérationnelle I
MPMC 328*	(3)	Environnement et gestion des rejets miniers
MPMC 329*	(2)	Géologie minière
	(3)	Géotechnique minière

MPMC 421* (3) Exploitation en souterrain

* Mining courses taken at Polytechnique Montréal

Stream B - Non-CEGEP Students

Non-CEGEP students must take the following courses:

CIVE 208	(3)	Civil Engineering System Analysis
MIME 329	(2)	Mining Geology
MIME 330	(3)	Mining Geotechnics
MIME 421	(3)	Rock Mechanics
MIME 424	(3)	Underground Mining Methods
MIME 428	(3)	Environmental Mining Engineering

Technical Complementaries (8-9 credits)

List A

3-9 credits must be chosen from the following:

MIME 320	(3)	Extraction of Energy Resources
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MIME 556	(3)	Sustainable Materials Processing
MPMC 320*	(3)	CAO et informatique pour les mines
SEAD 515	(3)	Climate Change Adaptation and Engineering Infrastructure
SEAD 520	(3)	Life Cycle-Based Environmental Footprinting
SEAD 550	(3)	Decision-Making for Sustainability in Engineering and Design

* Mining course taken at the Polytechnique Montreal

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
ECON 225	(3)	Economics of the Environment
ECON 347	(3)	Economics of Climate Change
ENVR 201	(3)	Society, Environment and Sustainability
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
MGPO 440*	(3)	Strategies for Sustainability
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

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

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

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

Anthropology (ANTH)

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CLAS 203

(3)

Greek Mythology

Knowledge, Ethics and En

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)

Note: FACC 100 (Introduction to the Engineering Profession) must be taken during the first year of study.

Required Non-Departmental Courses

37 credits

CIVE 205	(3)	Statics
CIVE 207	(4)	Solid Mechanics
COMP 208*	(3)	Computer Programming for Physical Sciences and Engineering
COMP 250*	(3)	Introduction to Computer Science
ECSE 209	(3)	Electrotechnology
EPSC 221	(3)	General Geology
EPSC 225	(1)	Properties of Minerals
FACC 100**	(1)	Introduction to the Engineering Profession
FACC 250	(0)	Responsibilities of the Professional Engineer
FACC 300	(3)	Engineering Economy
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
WCOM 206	(3)	Communication in Engineering

* Note: Students choose either COMP 208 or COMP 250.

** Note: FACC 100 (Introduction to the Engineering Profession) must be taken during the first year of study.

Required Mining Engineering Courses

53 credits

MIME 200	(3)	Introduction to the Minerals Industry
MIME 203	(2)	Mine Surveying
MIME 209	(3)	Mathematical Applications
MIME 260	(3)	Materials Science and Engineering
MIME 290	(2)	Industrial Work Period 1
MIME 291	(2)	Industrial Work Period 2
MIME 322	(3)	Fragmentation and Comminution
MIME 323	(3)	Rock and Soil Mass Characterization
MIME 325	(3)	Mineral Industry Economics
MIME 333	(3)	Materials Handling
MIME 340	(3)	Applied Fluid Dynamics
MIME 341	(3)	Introduction to Mineral Processing
MIME 392	(2)	Industrial Work Period 3
MIME 413	(3)	Strategic Mine Planning With Uncertainty
MIME 419	(3)	Surface Mining
MIME 422	(3)	Mine Ventilation
MIME 425	(3)	Applied Stochastic Orebody Modelling

MIME 426

(6)

Mine Design and Prefeasibility Study

Complementary Courses

31-32 credits

17 credits from one of Stream A or Stream B

Stream A - CEGEP Students

CEGEP students must take one of Stream A or Stream B

CFIN 410	(3)	Investment and Portfolio Management
CIVE 416	(3)	Geotechnical Engineering
CIVE 421	(3)	Municipal Systems
CIVE 573	(3)	Hydraulic Structures
CIVE 584	(3)	Mechanics of Groundwater Flow
COMP 417	(3)	Introduction Robotics and Intelligent Systems
EPSC 303	(3)	Structural Geology
EPSC 320	(3)	Elementary Earth Physics
EPSC 325	(3)	Environmental Geochemistry
EPSC 549	(3)	Hydrogeology

Economics (any 200- or 300-level course excluding 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) (excluding courses that principally impart language skills, such as Sanskrit, Tibetan, Tamil, New Testament Greek, and Biblical Hebrew) ***

School of Social Work (SWRK)

Sociology (excluding SOCI 350)

OR 3 credits from the following:

ARCH 528	(3)	History of Housing
BUSA 465*	(3)	Technological Entrepreneurship
CLAS 203	(3)	Greek Mythology
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
HISP 225	(3)	Hispanic Civilization 1
HISP 226	(3)	Hispanic Civilization 2
INDR 294*	(3)	Introduction to Labour-Management Relations
INTG 201**	(3)	Integrated Management Essentials 1
INTG 202**	(3)	Integrated Management Essentials 2
MATH 338	(3)	History and Philosophy of Mathematics
MGCR 222*	(3)	Introduction to Organizational Behaviour
MGCR 352*	(3)	Principles of Marketing
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>.

** Note: INTG 201 and INTG 202 are not open to students who have taken certain Management courses. Please see the INTG 201 and INTG 202 course information for a list of these courses.

*** If you are uncertain whether or not a course principally imparts language skills, please see an adviser in the McGill Engineering Student Centre (Frank Dawson Adams Building, Room 22) or email an adviser.

Note regarding language courses: Language courses are not accepted to satisfy the Complementary Studies Group B requirement, effective for students who entered the program as of Fall 2017.

9.9 Urban Planning

9.9.1 Location

Macdonald-Harrington Building, Room 400
 815 Sherbrooke Street West
 Montreal QC H3A 0C2
 Telephone: 514-398-4075
 Fax: 514-398-8376
 Email: admissions.planning@mcgill.ca

Website: mcgill.ca/urbanplanning

9.9.2 About the School of Urban Planning

Urban planning is the set of processes by which communities shape their environments to meet their needs and to realize their aspirations for the future. Urban planning is also the profession of those who facilitate this process. While the practice of planning is as old as the cities themselves, the profession of urban planning is only about a century old. In the late 19th and early 20th centuries, architects, landscape architects, engineers, government reformers, la

Department of Bioresource Engineering
Macdonald-Stewart Building, Room MS1-028
21,111 Lakeshore Road
Sainte-Anne-de-Bellevue QC H9X 3V9
Telephone: 514-398-7773
Fax: 514-398-7990
Website: mcgill.ca/bioeng

9.11 Minor Programs

This section includes general information concerning minors that are designed for students in the Faculty of Engineering.

Minors are coherent sequences of courses taken in addition to the courses required for the B.Eng. or B.Sc.(Arch.) degree. Minors normally consist of 18–24 credits, allowing 6–12 credits of overlap with the degree program (see individual minor program requirements for specific information regarding course overlap). The real credit cost to the student is typically 9–18 credits, representing one term beyond the B.Eng. or B.Sc.(Arch.) degree program. All courses in a minor must be passed with a grade of C or better.

Engineering students choose from a considerable variety of complementary courses under the categories of technical and complementary studies. Students should refer to their department for information concerning selection of complementary courses, and should see their departmental advisor. Departments also publish information regarding the choice of courses in this publication and in separate documents.

For enrolment in any other minors available at the University which is not listed below, please consult an advisor at MESC.



Note: Students are also permitted to register for minor concentrations offered by departments in the Faculty of Arts. To register in one of these minor concentrations, students must submit a request through the [Minor Webform](#) to obtain approval from the Faculty of Engineering. The Faculty of Engineering allows up to nine credits of overlap with the degree program for Engineering students taking Arts minor concentrations.

Minor Programs:

- *section 9.11.1: Bachelor of Engineering (B.Eng.) - Minor Aerospace Engineering (21 credits)*
- *section 9.11.2: Bachelor of Engineering (B.Eng.) - Minor Applied Artificial Intelligence (22-25 credits) (25 credits)*
- *section 9.11.3: Bachelor of Engineering (B.Eng.) - Minor Arts (24 credits)*
- *section 9.11.4: Bachelor of Engineering (B.Eng.) - Minor Biomedical Engineering (21 credits)*
- *section 9.11.5: Bachelor of Engineering (B.Eng.) - Minor Biotechnology (for Engineering Students) (24 credits)*
- *section 9.11.6: Bachelor of Engineering (B.Eng.) - Minor Chemistry (25 credits)*
- *section 9.11.7: Computer Science Courses and Minor Program*
- *section 9.11.8: Bachelor of Engineering (B.Eng.) - Minor Construction Engineering and Management (24 credits)*
- *section 9.11.9: Bachelor of Engineering (B.Eng.) - Minor Economics (18 credits)*
- *section 9.11.10: Minor in Environment*
- *section 9.11.11: Bachelor of Engineering (B.Eng.) - Minor Environmental Engineering (21 credits)*
- *section 9.11.12: Minor Program in Management*
- *section 9.11.13: Bachelor of Engineering (B.Eng.) - Minor Materials Engineering (24 credits)*
- *section 9.11.14: Bachelor of Engineering (B.Eng.) - Minor Mathematics (18 credits)*
- *section 9.11.15: Bachelor of Engineering (B.Eng.) - Minor Mining Engineering (23 credits)*
- *section 9.11.16: Minor in Musical Science and Technology*
- *section 9.11.17: Bachelor of Engineering (B.Eng.) - Minor Nanotechnology (n 9.11.12)*

Introduction to

CHEE 543	(3)	Plasma Engineering
MECH 544	(3)	Processing of Composite Materials
MECH 560	(3)	Eco-design and Product Life Cycle Assessment
MIME 512	(3)	Corrosion and Degradation of Materials
MIME 515*	(3)	(Bio)material Surface Analysis and Modification
MIME 559	(3)	Aluminum Physical Metallurgy
MIME 560	(3)	Joining Processes
MIME 563	(3)	Hot Deformation of Metals
MIME 565	(3)	Aerospace Metallic-Materials and Manufacturing Processes
MIME 571	(3)	Surface Engineering
MIME 580	(3)	Additive Manufacturing Using Metallic and Ceramic Materials

* Students may choose only one of CHEE 515 or MIME 515.

Avionics Stream

ECSE 403	(4)	Control
ECSE 408	(4)	Communication Systems
ECSE 412	(3)	Discrete Time Signal Processing
ECSE 420	(3)	Parallel Computing

COMP 250*	(3)	Introduction to Computer Science
ECSE 250*	(3)	Fundamentals of Software Development

* COMP 250 and ECSE 250 cannot both be taken.

Group B

4 credits from the following:

COMP 551*	(4)	Applied Machine Learning
ECSE 551*	(4)	Machine Learning for Engineers

* ECSE 551 and COMP 551 cannot both be taken

Group C

3g

ECSE 507	(3)	Optimization and Optimal Control
ECSE 526***	(3)	Artificial Intelligence
ECSE 544	(4)	Computational Photography
ECSE 552	(4)	Deep Learning
ECSE 554	(4)	Applied Robotics
ECSE 556	(4)	Machine Learning in Network Biology
ECSE 557	(3)	Introduction to Ethics of Intelligent Systems
MECH 559	(3)	Engineering Systems Optimization

*** COMP 424 and ECSE 526 cannot both be taken.

Or any 400 or 500 level special topics courses in the area of artificial intelligence with the approval of the Electrical and Computer Engineering department.

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

Minor Adviser: Faculty Student Adviser in the Engineering Student Centre (Frank Dawson Adams Building, Room 22)

B.Sc.(Arch.), and B.Eng., students may obtain the Arts Minor as part of their B.Eng., or B.Sc.(Arch.) degree by completing 24 credits, as described below.

BIOL 201*	(3)	Cell Biology and Metabolism
BIOL 219**	(4)	Introduction to Physical Molecular and Cell Biology
CHEM 212***	(4)	Introductory Organic Chemistry 1
PHGY 209	(3)	Mammalian Physiology 1
PHGY 210	(3)	Mammalian Physiology 2

* Students can choose one of ANAT 212, BIOC 212 or BIOL 201.

** Students can choose one of ANAT 212, BIEN 219, BIOC 212, BIOL 200, BIOL 201 or BIOL 219.

*** Cannot be taken by Chemical Engineering students.

Specialization Courses

Minimum of 12 credits from courses below:

Students must select 6 credits from courses outside their department and at least one BMDE course. BMDE courses are best tak

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 206*	(3)	Introduction to Signals and Systems
ECSE 517	(3)	Neural Prosthetic Systems
ECSE 526	(3)	Artificial Intelligence
PHYS 413	(3)	Physical Basis of Physiology

* Students choose either BIEN 350 or ECSE 206.

0-6 credits can be taken by permission of the Departmental Adviser and approval of the Minor Adviser.

9.11.5 Bachelor of Engineering (B.Eng.) - Minor Biotechnology (for Engineering Students) (24 credits)

Minor Adviser: Faculty Student Adviser in the McGill Engineering Student Centre (Student Affairs Office) (Frank Dawson Adams Building, Room 22). For advising regarding Science courses, contact Nancy Nelson, Undergraduate Adviser, Department of Biology, Faculty of Science.

This Minor is offered by the Faculty of Engineering and the Faculty of Science for students who wish to take biotechnology courses that are complementary to their area. It has been designed specifically for Chemical Engineering students; other Engineering students who are interested in the Minor should contact a Faculty Student Adviser in the McGill Engineering Student Centre (Student Affairs Office) (Frank Dawson Adams Building, Room 22).

To obtain the Biotechnology Minor, students must complete 24 credits, 18 of which must be exclusively for the Minor. Approved substitutions must be made for any of the required courses that are part of the student's major program.

The Department of Chemical Engineering permits students taking this Minor to complete BIOT 505 (Selected Topics in Biotechnology) as one of their technical complementary courses. Chemical Engineering students complete 15 credits beyond their 141-credit (115-credit for CEGEP students) B.Eng. program to obtain this Minor.

Required Courses

12 credits

BIOT 505	(3)	Selected Topics in Biotechnology
CHEE 200	(3)	Chemical Engineering Principles 1
CHEE 204	(3)	Chemical Engineering Principles 2
CHEE 474	(3)	Biochemical Engineering

OR

Alternative Required Courses (for Chemical Engineering students)

A Chemical Engineering student may complete the Biotechnology Minor by taking the courses below plus one course from the list of complementary courses, not including FACC 300.

BIOL 200	(3)	Molecular Biology
BIOL 201	(3)	Cell Biology and Metabolism
BIOL 202	(3)	Basic Genetics
BIOT 505	(3)	Selected Topics in Biotechnology
MIMM 211	(3)	Introductory Microbiology

Complementary Courses

12 credits selected from courses outside the Department of the student's major program and/or from the lists below. If courses are chosen from the lists below, at least three courses must be taken from one area of concentration as grouped.

Biomedicine

ANAT 541	(3)	Cell and Molecular Biology of Aging
EXMD 504	(3)	Biology of Cancer

PATH 300 (3) Human Disease

Chemistry

CHEM 482 (3) Organic Chemistry: Natural Products

CHEM 502 (3) Advanced Bio-Organic Chemistry

CHEM 552 (3) Physical Organic Chemistry

General

FACC 300 (3) Engineering Economy

Immunology

ANAT 261 (4) Introduction to Dynamic Histology

BIOC 503 (3) Biochemistry of Immune Diseases

(3) Introductory Immunology: Elements of Immunity

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

Physiology

EXMD 401	(3)	Physiology and Biochemistry Endocrine Systems
EXMD 502	(3)	Advanced Endocrinology 1
EXMD 503	(3)	Advanced Endocrinology 02
PHAR 562	(3)	Neuropharmacology
PHAR 563	(3)	Endocrine Pharmacology
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 557	(3)	Microbiology for Environmental Engineering

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

Minor Adviser (program coordinator): Dr. Samuel Sewall (Director of Undergraduate Studies, Chemistry)

Program credit weight: 25 credits

A passing grade for courses in 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 choose 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 213 (Introductory Physical Chemistry 1) and CHEM 273 (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 381	(3)	Inorganic Chemistry 2
CHEM 591	(3)	Bioinorganic Chemistry

Analytical Chemistry

CHEM 267	(3)	Introductory Chemical Analysis
CHEM 367	(3)	Instrumental Analysis 1
CHEM 377	(3)	Instrumental Analysis 2

Organic Chemistry

CHEM 302	(3)	Introductory Organic Chemistry 3
CHEM 362*	(2)	Advanced Organic Chemistry Laboratory
CHEM 482	(3)	Organic Chemistry: Natural Products

Physical Chemistry

CHEM 345	(3)	Introduction to Quantum Chemistry
CHEM 355	(3)	Applications of Quantum Chemistry
CHEM 493*	(2)	Advanced Physical Chemistry Laboratory
CHEM 574	(3)	Introductory Polymer Chemistry

9.11.7 Computer Science Courses and Minor Program

The School of Computer Science offers an extensive range of courses for students in the Faculty of Engineering who are interested in computers. Students in the Faculty of Engineering may obtain a **Computer Science Minor** by completing 24 credits of courses, passed with a grade of C or better.

Students interested in this Minor should contact:

Liette Chin
Undergraduate Program Coordinator
School of Computer Science
McConnell Engineering Building, Room 320
Telephone: 514-398-7071, ext. 00118
Email: liette.chin@mcgill.ca

and the Minor Adviser in the [School of Computer Science](#).

9.11.7.1 Computer Science Courses in Engineering Programs

The School of Computer Science offers an extensive range of courses for students in the Faculty of Engineering who are 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. programs are listed below.

Search [All Courses](#) for other courses offered by the School of Computer Sciences (subject code COMP).

Computer Science Courses in Engineering Programs

COMP 206	(3)	Introduction to Software Systems
COMP 208	(3)	Computer Programming for Physical Sciences and Engineering
COMP 250	(3)	Introduction to Computer Science
COMP 251	(3)	Algorithms and Data Structures
COMP 302	(3)	Programming Languages and Paradigms
COMP 360	(3)	Algorithm Design
COMP 421	(3)	Database Systems

9.11.7.2 Bachelor of Engineering (B.Eng.) - Minor Computer Science (25 credits)

24-26 credits

This program gives students in Engineering an introduction to core computer science concepts. The Minor is open to B.Eng. and B.Sc.(Arch.) students in Engineering who have already taken ECSE 202, COMP 202, or COMP 208. This program is not open to students in the B.Eng.; Co-op in Software Engineering program. All courses in the Minor must be passed with a grade of C or better. The Minor program may be completed in 24-26 credits, of which no more than 6 credits may overlap with the primary program. Students who are interested in this Minor should consult with the Undergraduate Program Coordinator. This program gives students in Engineering an introduction to core computer science concepts. The Minor is open to B.Eng. and B.Sc.(Arch.) students in Engineering who have already taken ECSE 202, COMP 202, or COMP 208. This program is not open to students in the B.Eng.; Co-op in Software Engineering program. All courses in the Minor must be passed with a grade of C or better. The Minor program may be completed in 24-26 credits, of which no more than 6 credits may overlap with the primary program. Students who are interested in this Minor should consult with the Undergraduate Program Coordinator in the School of Computer Science for administrative matters, and should consult with both the Minor Adviser in Computer Science and with their department adviser for approval of their course selection. Forms must be submitted and approved before the end of the drop/add period of the student's final term

Required Courses

3 credits

COMP 206	(3)	Introduction to Software Systems
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Complementary Courses (21-23 credits)

3 credits from the following:

COMP 250	(3)	Introduction to Computer Science
ECSE 250	(3)	Fundamentals of Software Development

3 credits from the following:

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

3-4 credits from the following:

COMP 273	(3)	Introduction to Computer Systems
ECSE 324	(4)	Computer Organization

3-4 credits from the following:

CHEE 390	(3)	Computational Methods in Chemical Engineering
CIVE 320	(4)	Numerical Methods
COMP 350	(3)	Numerical Computing
ECSE 343	(3)	Numerical Methods in Engineering
MATH 317	(3)	Numerical Analysis
MECH 309	(3)	Numerical Methods in Mechanical Engineering

9 credits from:

COMP 251	(3)	Algorithms and Data Structures
MATH 240	(3)	Discrete Structures

COMP courses at the 300 level or above except COMP 396, COMP 400.

It is strongly recommended that students take COMP 251, as it is a prerequisite of many later computer science courses.

9.11.8 Bachelor of Engineering (B.Eng.) - Minor Construction Engineering and Management (24 credits)

This Minor covers construction project management, law related to construction, labour-management relations, financial accounting and project finance, in addition to topics in other construction-related fields, architecture or mining engineering.

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

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

Minor Adviser: Prof. L. Chouinard, Macdonald Engineering Building, Room 491 (Telephone: 514-398-6446)

Minor program credit weight: 24 credits

Note: This Minor is particularly designed for Civil Engineering students, but is open to all B.Eng. and B.Sc.(Arch.) students.

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

Prerequisites

CIVE 208	(3)	Civil Engineering System Analysis
CIVE 302	(3)	Probabilistic Systems Computer Programming for Ph

Required Courses (18 credits)

6 credits from the following:

ECON 230D1	(3)	Microeconomic Theory
ECON 230D2	(3)	Microeconomic Theory
ECON 250D1	(3)	Introduction to Economic Theory: Honours
ECON 250D2	(3)	Introduction to Economic Theory: Honours

12 credits from:

ECON 209	(3)	Macroeconomic Analysis and Applications
ECON 225	(3)	Economics of the Environment
ECON 303	(3)	Canadian Economic Policy
ECON 304	(3)	Financial Instruments and Institutions
ECON 305	(3)	Industrial Organization
ECON 306	(3)	Labour Markets and Wages
ECON 308	(3)	Governmental Policy Towards Business
ECON 313	(3)	Economic Development 1
ECON 314	(3)	Economic Development 2
ECON 316	(3)	The Underground Economy
ECON 326	(3)	Ecological Economics
ECON 332*	(3)	Macroeconomic Theory: Majors 1
ECON 333*	(3)	Macroeconomic Theory - Majors 2
ECON 335	(3)	The Japanese Economy
ECON 336	(3)	The Chinese Economy
ECON 337	(3)	Introductory Econometrics 1
ECON 347	(3)	Economics of Climate Change
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
		Topics in Economic

* If chosen, students choose either ECON 209 or ECON 332 and ECON 333.

** Note: Only open to Mining and Materials Engineering students.

9.11.10 Minor in Environment

Environmental studies focus on the interactions between humans and their natural and technological environments. Environmental problems are complex, and their satisfactory solutions require the synthesis of social, scientific, and institutional knowledge.

The Minor in Environment is offered and administered by the Bieler School of Environment.

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 complete the Minor should prepare a program and have it approved by both their regular Engineering departmental advisor and the Minor program advisor. For program details, see [Bieler School of En](#)

BREE 518	(3)	Ecological Engineering
BREE 533	(3)	Water Quality Management

* Not open to students who have passed CIVE 323.

Courses offered at the Downtown campus:

ARCH 377	(3)	Energy, Environment, and Buildings 1
ARCH 515	(3)	Sustainable Design
CHEE 351	(3)	Separation Processes
CHEE 370	(3)	Elements of Biotechnology
CHEE 496	(3)	Environmental Research Project
CHEE 591	(3)	Environmental Bioremediation
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 520	(3)	Groundwater Hydrology
CIVE 550	(3)	Water Resources Management
CIVE 555	(3)	Environmental Data Analysis
CIVE 557	(3)	Microbiology for Environmental Engineering
CIVE 561	(3)	Greenhouse Gas Emissions
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)	Mechanics of Groundwater Flow
MECH 447	(3)	Combustion
MECH 534	(3)	Air Pollution Engineering
MECH 535	(3)	Turbomachinery and Propulsion
MECH 560	(3)	Eco-design and Product Life Cycle Assessment
MIME 422	(3)	Mine Ventilation
MIME 428	(3)	Environmental Mining Engineering
MIME 512	(3)	Corrosion and Degradation of Materials
MIME 556	(3)	Sustainable Materials Processing
MPMC 328	(3)	Environnement et gestion des rejets miniers
SEAD 515	(3)	Climate Change Adaptation and Engineering Infrastructure
SEAD 520	(3)	Life Cycle-Based Environmental Footprinting
SEAD 550	(3)	Decision-Making for Sustainability in Engineering and Design
URBP 506	(3)	Environmental Policy and Planning

** Not open to students who have passed BREE 217.

Non-Engineering Course List

Detailed information on the following Minor program can be found in [Desautels Faculty of Management > Undergraduate > Overview of Programs Offered by the Desautels Faculty of Management > : Minor for Non-Management Students](#):

- : [Bachelor of Commerce \(B.Com.\) - Minor Management \(For Non-Management Students\) \(18 credits\)](#)

Further information can also be found at mcgill.ca/engineering/students/undergraduate/advising-programs/minor-programs.

9.11.13 Bachelor of Engineering (B.Eng.) - Minor Materials Engineering (24 credits)

Minor Adviser: Prof. Richard Chromik (Minor Coordinator), Wong Building, Room 2620

Engineering students may obtain a Materials Engineering Minor by completing 24 credits chosen from the required and complementary courses listed below. By a careful selection of complementary courses, Engineering students may obtain this Minor with a minimum of 15 additional credits.

Required Courses

15 credits

CHEE 380*	(3)	Materials Science
CHEE 484	(3)	Materials Engineering
MIME 260*	(3)	Materials Science and Engineering
MIME 345	(3)	Applications of Polymers
MIME 465	(3)	Metallic and Ceramic Powders Processing
MIME 467	(3)	Electronic Properties of Materials

* Students choose either CHEE 380 or MIME 260.

Complementary Courses

9 credits from the following:

MECH 530	(3)	Mechanics of Composite Materials
MIME 360	(3)	Phase Transformations: Solids
MIME 512	(3)	Corrosion and Degradation of Materials
MIME 560	(3)	Joining Processes
MIME 561	(3)	Advanced Materials Design
MIME 563	(3)	Hot Deformation of Metals
MIME 569	(3)	Electron Beam Analysis of Materials

9.11.14 Bachelor of Engineering (B.Eng.) - Minor Mathematics (18 credits)

The B.Eng.; Minor in Mathematics provides students with an even stronger foundation in mathematics to further develop their knowledge of this subject. Students enrolled in the B.Eng.; Minor in Mathematics complete a series of mathematics courses offered by the Department of Mathematics and Statistics, or other units offering mathematics courses.

Minor Adviser: Faculty Student Adviser in the McGill Engineering Student Centre (Student Affairs Office) (Frank Dawson Adams Building, Room 22) AND an adviser designated by the Department of Mathematics and Statistics. (Please consult the Department of Mathematics and Statistics for the name of this adviser.) Selection of courses must be undertaken in conjunction with the Minor Advisers, normally beginning in the U2 year.

Note: The B.Eng.; Minor in Mathematics is open to all students in the Faculty of Engineering (including students registered in the B.Sc.(Arch.)). A maximum of 9 credits of overlap (double-counting) with the degree program is allowed.

Engineering students must obtain a grade of C or better in courses approved for this Minor.

Required Course (3 credits)

MATH 242	(3)	Analysis 1
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Complementary Courses (15 credits)

3 credits selected from:

MATH 223	(3)	Linear Algebra
MATH 247	(3)	Honours Applied Linear Algebra

6-12 credits selected from:

ECSE 205*	(3)	Probability and Statistics for Engineers
MATH 204	(3)	Principles of Statistics 2
MATH 240	(3)	Discrete Structures
MATH 243	(3)	Analysis 2
MATH 264	(3)	Advanced Calculus for Engineers
MATH 271**	(3)	Linear Algebra and Partial Differential Equations
MATH 316	(3)	Complex Variables
MATH 319**	(3)	Partial Differential Equations
MATH 323*	(3)	Probability
MATH 324*	(3)	Statistics
MATH 326	(3)	Nonlinear Dynamics and Chaos
MATH 340	(3)	Discrete Mathematics
MATH 378	(3)	Nonlinear Optimization
MATH 417	(3)	Linear Optimization
MATH 427	(3)	Statistical Quality Control
MATH 447	(3)	Introduction to Stochastic Processes
MATH 463	(0)	Convex Optimization
MATH 475	(3)	Honours Partial Differential Equations
MATH 478	(3)	Computational Methods in Applied Mathematics
MATH 563	(0)	Honours Convex Optimization

* Students who take ECSE 205 may not take MATH 323 or MATH 324.

** Students may take MATH 271 or MATH 319 but not both.

0-6 credits chosen from (200- to 500-level) Mathematics and Statistics courses approved for the B.Sc. Major Mathematics or B.Sc. Honours Mathematics programs, or from mathematics courses offered in other units. The courses in this category must be chosen in consultation with, and approved by, the Minor Adviser from the Department of Mathematics and Statistics.

Note: MATH 262, MATH 263 (or any course with substantial overlap in content with these two courses) and/or MATH 338 cannot be credited towards this minor.

9.11.15 Bachelor of Engineering (B.Eng.) - Minor Mining Engineering (23 credits)

Program credit weight: 23-25 credits

The Mining Engineering Minor covers fundamentals of mineral exploration, ore extraction, and mineral processing. The program includes an experiential learning component through an industrial work term for which enrolment may be limited.

Required Courses

17 credits

MIME 200	(3)	Introduction to the Minerals Industry
MIME 291	(2)	Industrial Work Period 2
MIME 322	(3)	Fragmentation and Comminution
MIME 325	(3)	Mineral Industry Economics

MIME 333	(3)	Materials Handling
MIME 341	(3)	Introduction to Mineral Processing

Complementary Courses (6-8 credits)

6-8 credits from one or more of the following groups:

List A: Mining Engineering

0-6 credits from the following:

MIME 320	(3)	Extraction of Energy Resources
MIME 323	(3)	Rock and Soil Mass Characterization
MIME 413	(3)	Strategic Mine Planning With Uncertainty
MIME 419	(3)	Surface Mining
MIME 421	(3)	Rock Mechanics
MIME 422	(3)	Mine Ventilation
MIME 424	(3)	Underground Mining Methods
MIME 425	(3)	Applied Stochastic Orebody Modelling
MIME 428	(3)	Environmental Mining Engineering
MIME 442	(3)	Analysis, Modelling and Optimization in Mineral Processing
MIME 511	(3)	Advanced Subsurface Ventilation and Air Conditioning
MIME 514	(3)	Sustainability Analysis of Mining Systems
MIME 520	(3)	Stability of Rock Slopes
MIME 544	(3)	Analysis: Mineral Processing Systems 1
MIME 545	(3)	Analysis: Mineral Processing Systems 2
MIME 588	(3)	Reliability Analysis of Mining Systems

List B: Mechanical Engineering

0-6 credits from the following:

MECH 497	(3)	Value Engineering
MECH 513	(3)	Control Systems
MECH 559	(3)	Engineering Systems Optimization
MECH 560	(3)	Eco-design and Product Life Cycle Assessment
MECH 572	(3)	Mechanics and Control of Robotic Manipulators
MECH 573	(3)	Mechanics of Robotic Systems

List C: Civil Engineering

0-6 credits from the following:

CIVE 416	(3)	Geotechnical 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	(3)	Process Control
CHEE 484	(3)	Materials Engineering

List E: Electrical Engineering

0-6 credits from the following:

ECSE 403	(4)	Control
ECSE 422	(3)	Fault Tolerant Computing
ECSE 428	(3)	Software Engineering Practice
ECSE 429	(3)	Software Validation
ECSE 444	(4)	Microprocessors
ECSE 464	(3)	Power Systems Analysis
ECSE 507	(3)	Optimization and Optimal Control

List F: Bioengineering

0-3 credits from the following:

BIEN 560	(3)	Design of Biosensors
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9.11.16 Minor in Musical Science and Technology

The Musical Science and Technology Minor focuses on interdisciplinary topics in science and technology applied to music. The goal of the program is to help prepare students for commercial jobs in the audio technology sector and/or for subsequent graduate research study. Enrolment in the MST Minor is limited to students with existing scientific backgrounds from all faculties at McGill University. Selection is based on prior experience in math, computer programming, and related sciences; expressed interest in the program; and Cumulative Grade Point Average (CGPA).

Detailed information on this program can be found in [Schulich School of Music > Undergraduate > Browse Academic Units & Programs > Department of Music Research: Composition; Music Education; Music History; Theory; Faculty Program > : Bachelor of Music \(B.Mus.\) - Minor Musical Science and Technology \(18 credits\)](#).

The online application form is available at mcgill.ca/music/programs/minor/mst and must be submitted by the application deadline.

For further information about this Minor, please visit website: mcgill.ca/music/programs/minor/mst

9.11.17 Bachelor of Engineering (B.Eng.) - Minor Nanotechnology (21 credits)

Through courses already offered in the Faculties of Science, Engineering, and Medicine and Health Sciences, depending on the courses completed, undergraduate students will acquire knowledge in some of the following areas related to nanotechnology:

- Nanomaterial synthesis and processing approaches
- Physicochemistry and quantum behavior of nanomaterials
- State-of-the-art techniques for nanomaterial characterization and detection
- Applications of nanomaterials in engineered solutions
- Nanomaterials in medicine and pharmacology
- Nanomaterials in electronics and energy
- Environmental, health, and social impacts of nanomaterials

Minor program credit weight: 21-22 credits

Students must complete 21 credits of courses as indicated below. A maximum of 12 credits of courses in the student's major may double-count with the Minor.

Students who have not taken the listed prerequisites for any of these courses should ensure that they have the adequate background and/or meet with the instructor before registering for the course. Permission from the instructor and/or department may be required.

The program is open to undergraduate students that are in Year 2 or higher.

Complementary Courses (21-22 credits)

Group A

Students must complete a minimum of 3 credits from the following list of courses:

BIEN 510	(3)	Engineered Nanomaterials for Biomedical Applications
BMDE 508	(3)	Introduction to Micro and Nano-Bioengineering
CHEE 521*	(3)	Nanomaterials and the Aquatic Environment
CHEM 534*	(3)	Nanoscience and Nanotechnology
CIVE 521*	(3)	Nanomaterials and the Aquatic Environment
ECSE 535**	(3)	Nanoelectronic Devices
MIME 570	(3)	Micro- and Nano-Fabrication Fundamentals
PHYS 534*	(3)	Nanoscience and Nanotechnology

Group B

Students will be required to take up to 18-19 credits of courses from Group B, depending on how many courses from Group A were taken.^

Bioengineering

BIEN 420	(3)	Biodevices Design for Diagnostics and Screening
BIEN 550	(3)	Biomolecular Devices

Chemical Engineering

CHEE 380*	(3)	Materials Science
CHEE 515*	(3)	Interface Design: Biomimetic Approach
CHEE 543	(3)	Plasma Engineering
CHEE 582	(3)	Polymer Science and Engineering
CHEE 585	(3)	Foundations of Soft Matter

Chemistry

CHEM 334	(3)	Advanced Materials
CHEM 531	(3)	Chemistry of Inorganic Materials
CHEM 582	(3)	Supramolecular Chemistry
CHEM 585	(3)	Colloid Chemistry

Electrical Engineering

ECSE 423	(3)	Fundamentals of Photonics
ECSE 430	(3)	Photonic Devices and Systems

Ph

MIME 262* (3) Properties of Materials in Electrical Engineering

Mechanical Engineering

MECH 500*** (3) Selected Topics in Mechanical Engineering

MECH 553 (3) Design and Manufacture of Microdevices

MECH 556 (3) Microfluidics and BioMEMS

MIME 260* (3) Materials Science and Engineering

Materials Engineering

MIME 261* (3) Structure of Materials

MIME 467 (3) Electronic Properties of Materials

MIME 515* (3) (Bio)material Surface Analysis and Modification

MIME 542 (3) Transmission Electron Microscopy

MIME 558 (3) Engineering Nanomaterials

MIME 569 (3) Electron Beam Analysis of Materials

MIME 571 (3) Surface Engineering

Pharmacology

PHAR 504 (3) Drug Discovery and Development 2

Physics

BIOL 319* (3) Introduction to Biophysics

PHYS 319* (3) Introduction to Biophysics

PHYS 346 (3) Majors Quantum Physics

PHYS 558 (3) Solid State Physics

* Students can take only one course from each set of the following courses:

- MIME 260, Tj1 0 0&T2ollo

Required Courses

9 credits

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

Complementary Courses (9 credits)

9 credits from the following:

PHYS 351	(3)	Honours Classical Mechanics 2
PHYS 362	(3)	Statistical Mechanics
PHYS 432	(3)	Physics of Fluids
PHYS 514	(3)	General Relativity
PHYS 551	(3)	Quantum Theory
PHYS 557	(3)	Nuclear Physics
PHYS 558	(3)	Solid State Physics
PHYS 559	(3)	Advanced Statistical Mechanics
PHYS 562	(3)	Electromagnetic Theory
PHYS 567	(3)	Particle Physics

9.11.19 Bachelor of Engineering (B.Eng.) - Minor Software Engineering (18 credits)

The Software Engineering Minor provides a foundation in basic computer science, computer programming, and software engineering practice. The Minor program does not carry professional recognition.

Students must complete 18 credits (six courses) as follows. Up to 6 credits (two courses) may be double-counted towards a degree program.

Required Courses (9 credits)

ECSE 223	(3)	Model-Based Programming
ECSE 321	(3)	Introduction to Software Engineering
ECSE 428	(3)	Software Engineering Practice

Complementary Courses

3 credits from the following:

COMP 250*	(3)	Introduction to Computer Science
ECSE 250*	(3)	Fundamentals of Software Development

6 credits from the following:

COMP 302	(3)	Programming Languages and Paradigms
COMP 307	(3)	Principles of Web Development
COMP 370	(3)	Introduction to Data Science
COMP 409	(3)	Concurrent Programming
COMP 421	(3)	Database Systems
COMP 424*	(3)	Artificial Intelligence

COMP 512

(4)

Distributed Systems

COMP 527

(3)

Logic and Computation

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Software Requirements Engineering

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MGCR 423	(3)	Strategic Management
MGCR 460	(3)	Social Context of Business.

3-6 credits from the following:

FACC 501	(3)	Technology Business Plan Project
MGPO 364	(3)	Entrepreneurship in Practice

0-3 credits from the following:

BUSA 465	(3)	Technological Entrepreneurship
LAWG 570	(3)	Innovation for Non-Law Students
MGPO 438	(3)	Social Entrepreneurship and Innovation
ORGB 321	(3)	Leadership