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

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8.1 The Faculty

8.1.1 Location
Macdonald Engineering Building
817 Sherbrooke Street West
Montreal, QC H3A 2K6
Canada
Website: www.mcgill.ca/engineering
Faculty of Engineering Student Affairs Office:
Macdonald Engineering Building, Room 378
Telephone: (514)398-7257

8.1.2 Administrative Officers
John E. Gruzleski; B.Sc., M.Sc.(Queen’s), Ph.D.(Tor.), Eng.
Dean
Jim Nicell; B.A.Sc., M.A.Sc., Ph.D.(Windsor), P.Eng.
Associate Dean (Student Affairs)
David L. Frost; B.A.Sc.(U.B.C.), M.S., Ph.D.(Caltech), P.Eng.
Associate Dean (Academic)
Frank Ferrie; B.Eng., Ph.D.(McG.)
Associate Dean (Research)

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

8.1.4 The Faculty Today
The Faculty currently includes five engineering departments and
two schools:

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

The Schools
Architecture
Urban Planning

The Faculty serves approximately 2,300 undergraduate students and
700 graduate students in a wide variety of academic pro-
grams.

Undergraduate programs leading to professional bachelor
degrees are offered in all Engineering Departments. These pro-
grams are designed to qualify the 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 wish to pursue a career in design
without being required to qualify for a professional degree.

The academic programs are divided into required and comple-
mentary sections. The required courses emphasize those basic
principles which permit graduates to keep abreast of progress in
technology throughout their careers. Exposure to current technol-
gy is provided by the wide variety of complementary courses
which allow students to pursue in depth a particular interest.

8.1.5.1 Engineering Microcomputing Facility
In addition to the services provided by the Computing Centre, the
Faculty, in conjunction with its departments and schools, main-
tains specialized computing and information resources in support
of teaching and research. These vary from desktop PCs distrib-
uted throughout the Engineering complex to very high perform-
ance scientific workstations found in the research laboratories.

The role of the Faculty is to provide access to computing
resources on a 24-hour basis and to provide services that are not
covered by individual units. The Faculty works in close coopera-
tion with the McGill Computing Centre, which provides remote
access to the Faculty network.

8.1.5.2 Bioresource Engineering
The Faculty of Engineering cooperates with the Faculty of Agricul-
tural and Environmental Sciences in providing courses of instruc-
tion for a curriculum in agricultural and biosystems engineering to
meet requirements for a professional degree awarded in the
Faculty of Agricultural and Environmental Sciences. The second
term of the penultimate year of the program is given by the Faculty
of Engineering on the downtown campus. For details of the curric-
ulum, see section 13.6.3 "Department of Bioresource Engineer-
ing".

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

8.1.5.3 Department of Biomedical Engineering
Lyman Duff Medical Sciences Building
3775 University Street
Montreal, QC H3A 2B4
Telephone: (514) 398-8278

Engineering undergraduates who are interested in the biomedical
applications of engineering techniques should contact the Chair of
their department or the graduate Chair of Biomedical Engineering.
Some of the courses offered by the Department (Subject Code
BMDE) may be of interest to Engineering students, and may be
approved as complementary courses. For more information, stu-
dents should see section 16 "Course Information, Regulations and
Descriptions".

8.1.6 Library Facilities
The University has numerous libraries. Specifically serving Engi-
neering, Architecture, and Urban Planning is the Schulich Library
of Science and Engineering. Other McGill libraries of interest to
students in the Faculty of Engineering are: Blackader-Lauterman
Library of Architecture and Art, Walter Hitisfield Geographic Informa-
tion Centre, Edward Rosenthal Mathematics and Statistics
Library, and the Howard Ross Management Library. Further infor-
mation is available on the Web at www.library.mcgill.ca.

8.2 General Information

8.2.1 Admission Requirements
The Faculty of Engineering offers programs leading to the degrees
of B.Eng. and B.Sc.(Arch.). Enrolment in some programs is lim-
ited.

Specific information on admissions requirements for Quebec
students, students from provinces of Canada other than Quebec,
and applicants from outside of Canada can be found in section
3.6.1 “Admission Requirements and Deadlines".

8.2.2 Exchange Programs
The Faculty of Engineering participates in a number of bilateral
exchange programs that provide undergraduates with an opportu-
nity to study in Australia, Austria, Canada, Denmark, France, Ger-
many, Hong Kong, Mexico, New Zealand, Singapore, Sweden,
United Kingdom, and US. Applicants must have completed at least
one year of study and have maintained an average of 3.00 or bet-
ter. Further information may be obtained from the Faculty of Engi-
neering Student Affairs Office, or the Exchange Officer,
Admissions, Recruitment and Registrar’s Office.
8.2.3 Transfer Credits

In certain cases, credit may be granted for courses passed with a grade of C or better at other universities, up to a maximum of 45 credits for Engineering and 42 credits for Architecture. For further information, please see section 4.6.5 “Transfer Credits”.

8.2.4 Registration

Students who are currently registered and intend to return to the same degree program in the following academic session are required to register following procedures outlined in this Calendar, see section 4.3 “Registration”. It is mandatory for all returning students to see a Departmental Academic adviser in their department for course confirmation during the first two weeks of the Fall term and, if changes are being made, during the first two weeks of the Winter term.

Information regarding course registration is sent to new students at the time of admission. All new students must see a Departmental Academic adviser during the advising period.

8.2.4.1 Registration for Continuing Education Courses

Students may register for Continuing Education courses through Minerva. Students must refer to the Centre for Continuing Education Calendar and Schedule for course information and deadlines. Language courses given through Continuing Education will not count for credits. For further information, contact the Student Affairs Office.

8.2.4.2 Course Withdrawal

Students may withdraw from a course without academic penalty provided they do so within the appropriate deadlines of the term. Beyond this time their names will appear on the mark reports and, in the event that they do not take the examination, they will be given a J grade.

8.2.5 Advising

All students are required to seek academic advising about their programs from the department in which they study. Additional information may be obtained by calling:

Student Affairs Office  (514) 398-7257
Architecture  (514) 398-6702
Chemical Engineering  (514) 398-4494
Civil Engineering  (514) 398-6860
Electrical and Computer Engineering  (514) 398-3943
Mechanical Engineering  (514) 398-8070
Metals and Materials Engineering  (514) 398-4755 ext. 4365
Mining Engineering  (514) 398-4755 ext. 0573
Urban Planning  (514) 398-4075

8.2.6 Student Activities

The campus offers a wide variety of extracurricular activities for students. All are encouraged to participate. Many of these are organized within the Faculty under the auspices of the Engineering Undergraduate Society (EUS), or the Architectural Student Association (ASA). Both of these organizations publish handbooks describing their operations and the activities of various Faculty clubs and societies. All undergraduate students automatically become members of the EUS or the ASA, as appropriate.

8.2.7 Scholarships and Bursaries

Scholarships, bursaries and loans are open to students in the Faculty of Engineering. Students should consult the Undergraduate Scholarships and Awards Calendar available on the Web at www.mcgill.ca/engineering/student/scholarships or from the Admissions, Recruitment and Registrar’s Office. Specific information concerning these awards may be obtained from the Student Affairs Office, Faculty of Engineering.

8.2.8 IYES: Internship Year for Engineering and Science

Employers value experience. The IYES Program allows students to gain professional work experience during the course of their undergraduate studies while at the same time earning a salary within the average range of those for entry-level professional positions. Other benefits include:

- improved chance of obtaining a job upon graduation and at a higher starting salary;
- the opportunity to test a choice of career and assess the pertinence of postgraduate study before making a long-term commitment;
- the opportunity to develop communication skills and to acquire a business perspective that cannot be learned in school and is unlikely to be gained from a summer job.

Employment through the IYES Program typically begins in January or May and continues for 8, 12 or 16 months, including a 4-month probationary training period. Employers choose the most suitable students for their organization through the application, interview and ranking process. While employed by the participating companies, students work on assignments related to their field of study. Students switch to the Internship Program from the regular program when they accept an Internship placement. Successful completion of an 8 to 16-month internship will qualify the student to graduate with the Internship Program designation, which will be noted on the student’s permanent record.

STUDENT ELIGIBILITY

All students participating in this program must:
- have a good academic record (satisfactory standing),
- be registered full time in their program,
- have between 15 and 45 credits remaining to complete their undergraduate studies in the following areas of Engineering or Science:

- Atmospheric Science
- Computer Science
- Biotechnology
- Electrical Engineering
- Chemical Engineering
- Environmental Studies
- Chemistry
- Mathematics and Statistics
- Civil Engineering
- Mechanical Engineering
- Computer Engineering
- Physics
- remain a degree candidate while on internship,
- return to complete studies at McGill (internship students will receive an automatic extension for the completion of their studies). Students are not allowed to complete their undergraduate degree during the internship period.

In addition, it is recommended that the student be able to demonstrate strong leadership and communication skills.

COST

- There is no application fee.
- Every student hired through the Program will be assessed a fee of $800. Students will be billed this amount approximately one month after starting their internship.
- Participating companies are invited to match the student’s contribution in the form of a tax deductible donation to IYES.

Further information can be obtained from the Website www.mecc.mcgill.ca or by sending an e-mail to info@mecc.mcgill.ca.

8.2.9 Calculators in Faculty Tests and Examinations

The use of calculators during tests and examinations is at the discretion of the course instructor. If a calculator is permitted in the examination, the Faculty requires that the students use a Faculty Standard Calculator, i.e., the CASIO fx-991 or the Sharp EL-546L, R, V(VB) and G only. These calculators are non-programmable, inexpensive, available through local dealers, e.g., EUS General Store in McConnell Engineering Building, and have many features of interest to Engineering students. Any model fx-991 or EL-546 is acceptable, regardless of the letter suffix which appears after the
model number. All Engineering students are expected to own one of the two Faculty Standard Calculators.

8.3 Academic Requirements

8.3.1 Degree Requirements

In order to obtain a Bachelor's degree, students must complete one of the departmental programs described in section 8.4 "Academic Programs".

8.3.1.1 Entrance Requirements

The degree programs in the Faculty of Engineering are designed for students who have completed a general and basic science program. This basic science requirement consists of two terms of calculus, chemistry, physics, one term of vectors, matrices and analytical geometry and one term of humanities or social sciences. Students entering the Faculty of Engineering from Quebec complete these courses at CEGEP and enter a seven-term program.

Students entering from outside Quebec with a high school diploma generally enter an eight-term program and complete the basic science requirements at McGill.

Students who have completed Advanced Placement Exams, Advanced Levels, the International Baccalaureate, or McGill placement and/or advanced credit examinations may receive exemptions and/or credits for all or part of the basic science requirements. Similarly, students who have completed courses at other universities or colleges may receive exemptions and/or credits. Please see www.mcgill.ca/engineering/newstudents/credit for specific information on transfer credits.

8.3.1.2 Basic Science Requirements for Students Entering from Outside Quebec

Generally, students admitted to Engineering from outside Quebec are required to complete the basic science requirements outlined below, in addition to the departmental programs described in section 8.4 "Academic Programs".

CHEM110 (4 credits) General Chemistry 1
CHEM120 (4 credits) General Chemistry 2
MATH140 (3 credits) Calculus 1
MATH141 (4 credits) Calculus 2
MATH150 (4 credits) Calculus A
MATH151 (4 credits) Calculus B
MATH152 (4 credits) Calculus E
MATH139 (3 credits) Calculus 1
MATH140 (3 credits) Calculus 2
PHYS131 (4 credits) Mechanics and Waves
PHYS142 (4 credits) Electromagnetism and Optics

Students may write McGill Placement Tests to obtain credit for CHEM110, CHEM120, MATH140, MATH141, MATH133, PHYS131 and PHYS142, in the event that they have studied similar material previously. Details on the advanced placement examinations are provided in Welcome to McGill. Information is also available on the Faculty Website at www.mcgill.ca/engineering/newstudents.

8.3.2 Degrees and Requirements for Professional Registration

Non-Professional:

Bachelor of Science (Architecture)

The first professional degree in architecture is the Master of Architecture I. The description of the M.Arch. I program can be found in the Graduate and Postdoctoral Studies Calendar.

Professional:

Bachelor of Engineering
Bachelor of Engineering (Honours)
Bachelor of Software Engineering

The B.Eng. programs are accredited by the Accreditation Board of the Canadian Council of Professional Engineers and fulfill the academic requirements for admission to the provincial engineering professional organizations. All students are encouraged to seek professional registration after graduation. To become a Professional Engineer in Canada, a graduate must pass an examination on legal aspects as well as on the principles of professional practice, and acquire two to four years of engineering experience, depending on the province. Only persons duly registered may use the title of "engineer" and perform the professional activities reserved for engineers by the provincial laws and regulations.

Graduates of the Bachelor of Software Engineering program should be eligible for accreditation (once accreditation standards for Software Engineers have been adopted).

In Quebec, the professional engineering body is the Ordre des ingénieurs du Québec (OIQ). In order to better prepare new graduates for the practice of their profession, McGill organizes seminars in cooperation with the OIQ on various aspects of the profession. The OIQ also has a student section. As soon as students have accumulated 60 credits in a B.Eng. program, they can join the Student Section of the OIQ. Registration is free.


8.3.3 Prerequisites and/or Corequisites

Prerequisites and/or corequisites must be completed prior to course registration, if applicable. If a student has registered for a course and did not satisfy the prerequisites and/or corequisites, the course may be dropped from his/her record automatically by Minerva.

Welcome to McGill
Those students who have received advance credits/exemptions or passed a placement exam and are blocked from registration in a course due to a prerequisite and/or corequisite block, must complete a Course Authorization Form and submit it to the Faculty of Engineering Student Affairs Office. A Departmental advisor must sign and make a notation on the Course Authorization Form indicating that the prerequisite and/or corequisite has been satisfied. Further information may be obtained from the Faculty of Engineering Student Affairs Office, Macdonald Engineering Building, Room 378.

8.3.4 Complementary Studies

Engineering students must complete 6 credits of additional complementary courses as follows:

I) Three credits on the impact of technology on society are to be chosen from the following list of courses:

- CHEE230 Environmental Aspects of Technology
- CHEE430 Technology Impact Assessment
- CIVE469 Infrastructure and Society
- ECON225 Economics of the Environment
- ENVR201 Society and Environment
- ENVR 480 Topics in Environment 2
- GEOG200 Geographical Perspectives: World Environmental Problems
- GENG203 Environmental Systems
- GENG205 Global Change: Past, Present and Future
- GENG302 Environmental Management 1
- MIME308 Social Impact of Technology
- PHIL343 Biomedical Ethics
- SOCIO235 Technology and Society
- SOCIO312 Industrial Sociology

II) Three credits in the humanities and social sciences, administrative studies and law are to be chosen from the following list of courses:

A. Humanities and Social Sciences

Any course at the 200 level or above from the departments of:
- Anthropology (Subject Code ANTH)
- Economics (any 200- or 300-level course excluding ECON208, ECON217, ECON227, ECON259 and ECON337)
- History (Subject Code HIST)
- Philosophy (excluding PHIL210)
- Political Science (Subject Code POLI)
- Psychology (excluding PSYC204, PSYC305 and PSYC435 but including PSYC100)
- Religious Studies (Subject Code RELG)
- School of Social Work (Subject Code SWRK)
- Sociology (excluding SOCIO350)
- or ARCH350 The Material Culture of Canada
- or ENVR203 Knowledge, Ethics and Environment
- or ENVR400 Environmental Thought
- or MATH338 History and Philosophy of Mathematics

B. Administrative Studies and Law

Faculty of Engineering
- FACC220 Law for Architects and Engineers
- FACC 500 Technology Business Plan Design
- FACC 501 Technology Business Plan Project

Faculty of Management

(Management courses have limited enrolment and registration dates, see Calendar of Dates.)
- BUSA465 Technological Entrepreneurship
- INDR294 Introduction to Labour-Management Relations
- MGCR222 Introduction to Organizational Behaviour
- MGCR320 Managing Human Resources
- MGCR352 Marketing Management 1
- MGCR360 Social Context of Business
- MKT360 Marketing of Technology
- ORGB321 Leadership

C. Language Courses

Any language course which is deemed by the academic adviser to have a sufficient cultural component or, in the case of a student who was not already proficient in a specific language, program credit will be given for the second of two successfully completed, academically approved 3-credit language courses.

8.3.5 Student Progress

The B.Eng. programs may be completed in seven terms. The B.Sc.(Arch.) program may be completed in six or eight terms, depending upon point of entry. A student must successfully complete the B.Eng. or B.Sc.(Arch.) programs within six years of entry. Candidates admitted to a lengthened program, or to a shortened program because of advanced standing, or who are participating in the IYES program, will have a correspondingly greater or lesser period in which to complete their program. Extensions may be granted by the Committee on Standing in cases of serious medical problems or where other similarly uncontrollable factors have affected a student’s progress.

8.3.5.1 Letter Grades

In the Faculty of Engineering, letter grades are assigned according to the grading scheme adopted by the professor in charge of a particular course. They have the designations:

- A, A- Very Good
- B+, B, B- Good
- C+, C Satisfactory
- D Conditional Pass
- F Failed
- T Credit by examination only

Grades A, B and C indicate satisfactory results. Grade D indicates marginal results which may be acceptable for peripheral courses but not for core courses required by the program. The classification of a course as core or peripheral depends on the individual student’s program and will be decided by the department concerned. Grade F is a permanent grade indicating unsatisfactory results. Grade T indicates an unexcused failure to submit assignments or an unexcused absence from an examination. It is equivalent to an F grade.

8.3.5.2 Incomplete Course Deadlines

Those students with a K grade (incomplete) MUST complete the course within three (3) months, after which the student will be given a grade of KF (incomplete/failed). The deadline for Fall term courses is March 31 (January 15 for Winter graduation); for Winter term courses it is August 15 (May 15 for Spring graduation) and for Summer term courses it is December 1 (October 1 for Fall graduation).

If the student is unable to complete the course within the given deadlines, a request for an extension must be forwarded to the Associate Dean (Student Affairs). If an extension has already been permitted, the Faculty will make the necessary corrections.

8.3.5.3 Satisfactory/Unsatisfactory Option

The Satisfactory/Unsatisfactory Option (S/U) may be used for elective courses only. Students must specify courses as S/U at the time of registration. The option will not be manually added or removed from a student’s record after the Add/Drop deadline. Once a mark has been submitted, this option will not be reversed.

1. “Elective” refers to that category of the complementary studies component of the program involving a Social Science/Humanities course, or a course dealing with the impact of technology on society; or to elective courses taken outside the School of Architecture by architecture students. It does not apply to the “technical complementsaries” or “architectural complementsaries”, or to any other category of the Engineering or Architecture programs.

2. A C grade is considered a pass under the University Satisfactory/Unsatisfactory option. (Students should note that the Faculty of Engineering accepts a D grade as a pass when courses
eligible for the S/U option are taken in the conventional manner.)

3. Only students in satisfactory standing will be permitted to take a course under the Satisfactory/Unsatisfactory option. Only one course (3 credits) per term, to a maximum of 10% of a student's credits taken at McGill, may be taken this way. Grades will be reported in the normal fashion by the instructor and the grades of C and above will be converted to Satisfactory (S) and grades of D and F will be converted to Unsatisfactory (U).

4. The courses taken under this option will be excluded from the GPA, but will be included in the number of credits.

5. Note: For Faculty of Engineering Students Only: If the S/U option is selected for a core course and not removed by the Course Change deadline, the Student Affairs Office will remove the option and notify the student of the change.

Note: To be considered for scholarships/renewal of awards, students must complete at least 27 credits in the regular academic session exclusive of courses completed under this option.

8.3.5.4 Course Credits
The credit assigned to a particular course reflects the amount of effort it demands of the student. One credit normally represents three hours total work per week. This is, in general, a combination of lecture hours and other contact hours such as laboratory periods, tutorials and problem periods as well as personal study hours. As a guide, the average division of time for a course is indicated in hours in the course listing after the course credit. For example, (3)(3-0-6) indicates a three-credit course consisting of three lecture hours per week, no other contact hours and six hours of personal study per week.

8.3.5.5 Extra Courses
Courses that a student elects to take which lie outside their program may be classified as "extra", provided the student chooses this option at the time of registration. Extra courses are indicated on the student's transcript and grades earned in those courses do not affect the grade point average. The option will not be added to a student's record after the Add/Drop deadline. Courses that are taken to satisfy the student's engineering program or a Minor cannot be designated as extra.

8.3.5.6 Academic Standing Decisions
In the Faculty of Engineering, a decision on the student's academic standing is based on the CGPA (Cumulative Grade Point Average) according to the criteria listed below.

• Satisfactory standing - CGPA equal to 2.00 or greater.
• Probationary standing - CGPA less than or equal to 1.99 or equal to or greater than 1.20.
• Unsatisfactory standing - CGPA less than 1.20. (If this is the student's first term, the student is normally readmitted to Probationary Standing by Faculty decision).

Note: The Faculty makes academic standing decisions after the completion of each term (Fall, Winter, Summer) based on academic results to date. Thus, if a student has been granted permission to defer one or more examinations, the standing decision will be made regardless of such deferrals.

Please see below for further information about academic standing decisions.

Satisfactory Standing
Students in satisfactory standing may proceed, with the following conditions:

- All core courses in which D or F grades were obtained must either be repeated successfully (grade C or better) or be replaced by an alternative approved course which is completed successfully.
- All other courses in which F grades were obtained must either be repeated successfully at some point before graduation or be replaced by some alternative approved course which is completed successfully before graduation.

Students in poor academic standing are strongly urged to contact the Student Affairs Office to discuss their situation. Office staff are available to help guide students and to provide useful advice to help students achieve their goals. Helpful workshops are provided by Student Services, e.g., study skills, stress management, test anxiety. Students who are experiencing difficulties are encouraged to explore these avenues.

Probationary Standing
Students placed on Probationary Standing may proceed with their studies under the following conditions:

- Students must reduce their credit load to a maximum of 13 credits per term and must achieve at the end of the term either a CGPA of 2.00 or better, or a term GPA (TGPA) of 2.50 or better in order to continue.
- A student whose TGPA is 2.50 or better, whose CGPA is less than 2.00, may continue on with his/her studies but will remain on Probationary Standing.
- Failure to achieve either the TGPA or CGPA requirements noted above will result in the student being placed on "Unsatisfactory Standing" (see below). Students will remain on probationary standing until they achieve a CGPA equal to or exceeding 2.00, at which time their standing will be changed to "satisfactory".
- Students placed on Probationary Standing who need to reduce their credit load but are unable to drop course(s) must complete a Course Authorization Form and submit it to the Student Affairs Office. The course(s) will then be deleted manually from the student's record.

Unsatisfactory Standing
Students who have been placed on Unsatisfactory Standing will be asked to withdraw from the Faculty of Engineering for a minimum of one term. Courses for which the student is currently registered will be deleted automatically from the student's record by the Faculty.

After a minimum of one term away, the student can apply for readmission no later than November 1 (Winter term) and June 1 (Fall term). A request for readmission must be made in writing in a letter addressed to the Associate Dean, Student Affairs in the Student Affairs Office. Upon readmission, the student will be placed back on Probationary Standing. Students will remain on probationary standing until they achieve a CGPA greater than or equal to 2.00, at which time their standing will be changed to "satisfactory".

While on probation during that term and subsequent terms, the student must reduce his/her credit load to a maximum of 13 credits per term, and must meet or exceed the minimum TGPA specified by the department or a CGPA greater than or equal to 2.00. The minimum TGPA requirement for each department is as follows:

- Department of Chemical Engineering: TGPA greater than or equal to 2.50
- Department of Civil Engineering and Applied Mechanics: TGPA greater than or equal to 2.50
- Department of Electrical and Computer Engineering: TGPA greater than or equal to 3.00
- Department of Mechanical Engineering: TGPA greater than or equal to 2.50
- Department of Mining, Metals and Materials Engineering: TGPA greater than or equal to 2.50
- School of Architecture: TGPA greater than or equal to 2.50

Students who fail to achieve the minimum TGPA required by their department will be required to permanently withdraw from the program with no chance of readmission. In addition, students who have returned to satisfactory standing, but whose CGPA falls below 2.00 in a subsequent term, will be required to permanently withdraw from the program with no chance of readmission.

8.3.5.7 Repeated Courses
Students who fail to achieve the required results in a course must either repeat it successfully or complete a substitute course approved by their department. For students who fail prerequisite courses which are offered only in the Fall or Winter, the depart-
ment responsible may, in appropriate cases, arrange “reading courses” during the other term or during the Summer months. Such courses taken during a Fall or Winter term constitute a normal part of the candidate's work load. If the student is on probation, these courses must be included in the workload reduction.

8.3.5.8 Reassessment and Reread of a Grade
In accordance with the Charter of Student Rights, and subject to the conditions stated therein, students have the right to consult any written submission for which they have received a mark and the right to discuss this submission with the examiner. If, after discussion with the instructor, a student decides to request a formal reread of a final exam, the student must apply in writing, complete the Reread form and submit it to the Faculty of Engineering Student Affairs Office.

The following conditions apply:
- requests for rereads in more than one course per term will not be accepted, unless permission is given by the Faculty of Engineering;
- grades may be either raised or lowered as the result of a reread;
- rereads in courses not in the Faculty of Engineering are subject to the deadlines, rules and regulations of the relevant faculty;
- any request to have term work re-evaluated must be made directly to the instructor concerned.

The deadlines to make an application for a formal reread of a final exam are:
- the last working day of March for Fall courses,
- the last working day of July for Winter courses, and
- the last working day of November for Summer courses.

A $35 fee for each reread will be assessed directly to the student’s McGill account if the result remains the same or is lowered. If the grade is increased, no charge is made.

For further information, students may consult the Faculty of Engineering Student Affairs Office.

8.3.5.9 Examination Regulations
For information regarding examination regulations and procedures in the Faculty of Engineering, please refer to the Engineering Website at www.mcgill.ca/engineering.

8.3.5.10 Supplemental Examinations
Courses administered by the Faculty of Engineering do not have supplemental examinations; however, Engineering students may be eligible to write supplemental examinations in courses administered by the Faculties of Arts and Science (i.e., typically Humanities and Social Science courses and freshman (U0) courses).

The following conditions apply:
- students must be in satisfactory or probationary standing; those with an unsatisfactory standing are not permitted to write supplements;
- students are permitted to write a supplemental for courses in which they have received a mark of D, F, J or U;
- students must write the supplemental exam at the time of the next supplemental examination period;
- special permission of the Associate Dean (Student Affairs), Faculty of Engineering, is required if a student wishes to write supplemental exams totalling more than seven (7) credits.
- only one supplemental examination is allowed in a course;
- the supplemental result may or may not include the same proportion of class work as did the original grade. The instructor will announce the arrangements to be used for the course by the end of the course change period;
- the supplemental result will not erase the grade originally obtained; both the original mark and the supplemental result will be calculated in the CGPA;
- additional credit will not be given for a supplemental exam where the original grade for the course was a D and the student already received credit for the course.

The supplemental examination period for Fall courses is during the months of April and May, and for Winter courses and courses spanning Fall/Winter during the last week of August. It is the student’s responsibility to confirm the date and time of the supplemental exam (www.mcgill.ca/engineering/student/policies/exams/supplements). Supplemental exam applications are available from the Faculty of Engineering Student Affairs Office. Alternately, students may print out the Supplemental Examination Request Form from the Faculty Website and return it by mail or submit it to the Student Affairs Office.

The deadline for submission of applications is March 1 for Fall courses and July 15 for Winter courses and courses spanning Fall/Winter terms.

There is a $35 non-refundable fee per each supplemental exam, which is charged directly to the student’s McGill student account.

Students should consult the Faculty of Engineering Student Affairs Office for more information.

8.3.5.11 Deferred Examinations
Students who have missed a final examination due to illness or family affliction must submit the following documentation to the Faculty of Engineering Student Affairs Office, Room 378, Macdonald Building:
- an original medical certificate or other documentation that covers the date of the missed examination, and the nature and duration of the illness;
- a completed Deferral Request Form;
- a detailed letter justifying the request for a deferral.

Students must also attest that they have completed all coursework up to date, which will be verified with the instructor(s). The Student Affairs Office must be informed of the reasons for absences from final examination no later than one week after the date of the final examination that was missed.

A student’s signature on the Deferral Request Form will allow the Faculty to verify the authenticity of the medical certificate and the nature of the illness, or any other documentation provided. If the form is not signed, it will result in the assignment of a J grade in the course.

If a student becomes ill during a formal examination, he/she must inform the invigilator as soon as possible. If necessary, the student will be escorted to the Health Services. As stated above, the student must return to the Faculty of Engineering Student Affairs Office with medical certification within one week of the exam. IMPORTANT: If a student completes the exam in routine fashion, the grade received CANNOT be changed.

Students are advised that deferrals are granted ONLY for compelling reasons. If the request for deferral is denied by the Associate Dean (Student Affairs) the student will receive a “J” grade (absent) in the course. For the purpose of calculating GPAs and CGPAs, the grade of “J” is treated as an “F” (failed, 0%). Students will be contacted regarding the approval of a deferral initially via e-mail approximately two weeks after the end of examination period. A formal letter will be mailed at a later date.

Students granted a deferral will be given an “L” grade which will be replaced by a “J” should the students miss the next deferred or regular examination in the course, whichever occurs first. Please note that you are ONLY allowed to write the final exam for the course in which you have been granted a deferral. You are NOT allowed to redo any portion of the coursework such as assignments, projects, labs, midterms, quizzes, etc. without the prior explicit permission of the Associate Dean, Student Affairs. Such permission is ONLY granted in exceptional circumstances, which you can request by providing a detailed justification of your reasons in a letter to the Associate Dean.

If a deferral is granted, the maximum number of courses that a student may register for will be limited to ensure that no more than 18 credits of course work are to be satisfied in a single term or no more than 6 exams are to be written, whichever is greater. This will provide a student with sufficient time during the term and the exam period to properly prepare for deferred examinations.
8.4 Academic Programs

The curricula described in the following pages, and the courses listed under section 16 "Course Information, Regulations and Descriptions", have been approved for the 2005-06 session, but the Faculty reserves the right to introduce changes as may be deemed necessary or desirable.

8.4.1 School of Architecture

Macdonald-Harrington Building, Room 201
815 Sherbrooke Street West
Montreal, QC H3A 2K6
Telephone: (514) 398-6700
Fax: (514) 398-7372
Website: www.mcgill.ca/architecture

Director — David Covo

Emeritus Professors

Professors
Derek Drummond; B.Arch.(McG.), F.R.A.I.C., O.A.A. (William C. Macdonald Professor of Architecture)
Avi Friedman; B.Arch.(Technion), M.Arch.(McG.), Ph.D. (Montr.), O.A.O., I.A.A.
Alberto Pérez-Gómez; Dipl.Eng.(Nat.Pol.Inst.Mexico), M.A., Ph.D.(Essex) (Saidye Rosner Bronfman Professor of Architectural History)
Adrian Sheppard; B.Arch.(McG.), M.Arch.(Yale), F.R.A.I.C., O.A.Q., A.A.P.P.Q.

Associate Professors
Anne Marie Adams; B.A.(McG.), M.Arch., Ph.D.(Berkeley), M.R.A.I.C. (William Dawson Scholar)
Martin Bressani; B.Sc.(Arch.), B.Arch.(McG.), M.Sc.Arch., Diplomes des études approfondies, Docteur de l’Université de Paris-Sorbonne(Paris IV)
Ricardo Castro; B.Arch.(Los Andes), M.Arch., M.A. (Art History)
(Ore.), M.R.A.I.C.
David Covo; B.Sc.(Arch.), B.Arch.(McG.), F.R.A.I.C., O.A.Q.
Pieter Sijpkes; B.Sc.(Arch.), B.Arch.(McG.)

Faculty Lecturer
Julia Bourke

Course Lecturers
Cameron Charlebois, Robert Claiborne, Odile Henault, Emmanuelle Lapointe, Nadia Meratia, Carole Scheffer, David Theodore

Adjunct Professors

Research Associates
Jim Donaldson, Rafik Salama

Associate Members
Clarence Epstein, Tania Martin, Howard Shubert

Visiting Critics and Lecturers
Each year visitors are involved in the teaching of certain courses as critics and lecturers. These visitors change from year to year. In 2004, they were:

ARCHITECTURAL CERTIFICATION IN CANADA

In Canada, all provincial associations recommend a degree from an accredited professional degree program as a prerequisite for licensure. The Canadian Architectural Certification Board (CAB), which is the sole agency authorized to accredit Canadian professional degree programs in architecture, recognizes two types of accredited degrees: the Bachelor of Architecture and the Master of Architecture. A program may be granted a five-year, three-year, or two-year term of accreditation, depending on its degree of conformance, with established educational standards.

Master’s degree programs may consist of a pre-professional undergraduate degree and a professional graduate degree, which, when earned sequentially, comprise an accredited professional education. However, the pre-professional degree is not, by itself, recognized as an accredited degree.

Since all provincial associations in Canada recommend any applicant for licensure to have graduated from a CACB-accredited program, obtaining such a degree is an essential aspect of preparing for the professional practice of architecture. While graduation from a CACB-accredited program does not assure registration, the accrediting process is intended to verify that each accredited program substantially meets those standards that, as a whole, comprise an appropriate education for an architect.
PROGRAMS OF STUDY
McGill’s professional program in architecture is structured as a four-and-a-half-year, or nine-term, course of study divided into two parts.

The first part, for students entering with the Diploma of Collegial Studies in Pure and Applied Science or the equivalent, is a six-term design program leading to a non-professional degree, Bachelor of Science (Architecture). [Most students from outside Quebec are admitted to an eight-term B.Sc.(Arch.) program and enter a first year which includes courses outlined in section 8.3.1.3 “Architecture – Basic Science Requirements for Students Entering from Outside Quebec”].

The second part, for students with the B.Sc.(Arch.) degree, is a one-and-a-half-year, or three-term, program leading to the professional Master of Architecture I degree. The professional M.Arch.I is accredited by the Canadian Architectural Certification Board (CABC), and is recognized as accredited by the National Council of Architectural Registration Boards (NCARB) in the USA.

Students in the B.Sc.(Arch.) program who intend to proceed to the professional degree must satisfy certain minimum requirements including:

1. 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;
2. submit a portfolio of work executed in the sequence of six design studios, as well as samples of professional and personal work;
3. complete the minimum period of relevant work experience according to the current Work Experience Guidelines.

Further information on the professional M.Arch.I program is available on the Web at www.mcgill.ca/architecture.

Student Exchanges
A limited number of qualified students may participate in an exchange with schools of architecture at other universities which 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: Facultad de Arquitectura, Universidad de Los Andes, Bogotá, Colombia; Istituto Universitario di Architettura di Venezia, Venice, Italy; Fakultät für Raumplanung und Architektur, Technische Universität Wien, Vienna, Austria; The Technion - Israel Institute of Technology, Haifa, Israel; Institut Supérieur d’Architecture, Saint-Luc Bruxelles, Brussels, Belgium; Ecole d’architecture de Grenoble, Grenoble, France; École d’architecture Clermont-Ferrand, Clermont-Ferrand, France; Facolta di Architettura Civile Politecnico di Milano (Boviso); Virginia Polytechnic Institute and State University, Faculty of Architecture; Alexander Centre for Architecture and Urban Studies (M.Arch. only), Universidad Nacional Autonoma de Mexico, Facultad de Arquitectura; Tecnologico de Monterrey (Campus Queretero), Departamento de Arquitectura; University of Florida, School of Architecture.

ANCILLARY ACADEMIC FACILITIES
Laboratories and Workshops
Architectural Workshops – David Speller, Technician
Communications Laboratory, including Photo Lab – Carrie Henzie, Media Technician
Computers in Architecture Laboratories – Professor Robert Mellin
Building Science Resource Centre – Dr. Avi Friedman
Library
Blackader-Lauterman Library of Architecture and Art, located in the Redpath Library – Marilyn Berger
Collections
Visual Resources Collection, including slides, film, video and other materials – Dr. Annmarie Adams

Canadian Architecture Collection, housed in the Blackader-Lauterman Library – David McKnight (Acting Chief Curator – 2004-2005)
Orson Wheeler Architectural Model Collection – Professor Pieter Sijpkes
Materials Resource Centre – Dr. Avi Friedman

CURRICULUM FOR THE B.Sc.(Arch.) DEGREE
Current information on program structure and courses is posted on the School of Architecture Website at www.mcgill.ca/architecture.

REQUIRED COURSES

<table>
<thead>
<tr>
<th>COURSE</th>
<th>CREDIT</th>
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<tbody>
<tr>
<td>Non-Departmental Subjects</td>
<td></td>
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<tr>
<td>CIVE205 Statics</td>
<td>3</td>
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<tr>
<td>CIVE283 Strength of Materials</td>
<td>4</td>
</tr>
<tr>
<td>CIVE385* Structural Steel and Timber Design</td>
<td>3</td>
</tr>
<tr>
<td>CIVE388* Foundations and Concrete Design</td>
<td>3</td>
</tr>
<tr>
<td>CIVE492* Structures</td>
<td>2</td>
</tr>
<tr>
<td>FAC220 Law for Architects and Engineers</td>
<td>3 18</td>
</tr>
</tbody>
</table>

* Candidates intending not to proceed to the M.Arch. I degree may substitute other courses of equal total weight for any of these.

Architectural Subjects

<table>
<thead>
<tr>
<th>COURSE</th>
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<tbody>
<tr>
<td>ARCH201 Communication, Behaviour and Architecture</td>
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<tr>
<td>ARCH224 Architectural Graphics and Design Elements</td>
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</tr>
<tr>
<td>ARCH217 Freehand Drawing 1</td>
<td>1</td>
</tr>
<tr>
<td>ARCH218 Freehand Drawing 2</td>
<td>1</td>
</tr>
<tr>
<td>ARCH240 Organization of Materials in Building</td>
<td>3</td>
</tr>
<tr>
<td>ARCH250 Architectural History 1</td>
<td>3</td>
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<tr>
<td>ARCH251 Architectural History 2</td>
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<td>ARCH303 Design and Construction 1</td>
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<td>ARCH321 Freehand Drawing 3</td>
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<td>ARCH322 Freehand Drawing 4</td>
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<tr>
<td>ARCH324 Sketching School 1</td>
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<tr>
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<tr>
<td>ARCH355 Architectural History 4</td>
<td>3</td>
</tr>
<tr>
<td>ARCH375 Landscape</td>
<td>2</td>
</tr>
<tr>
<td>ARCH377 Energy, Environment and Buildings</td>
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</tr>
<tr>
<td>ARCH405 Design and Construction 3</td>
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<tr>
<td>ARCH406 Design and Construction 4</td>
<td>6</td>
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<tr>
<td>ARCH447 Electrical Services</td>
<td>2</td>
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<tr>
<td>ARCH451 Building Regulations and Safety</td>
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</tbody>
</table>

COMPLEMENTARY COURSES 12
Students must complete 12 credits of architectural complementsaries, which must include at least one course from each of the areas of concentration listed below in order to qualify for the B.Sc.(Arch.) degree.

<table>
<thead>
<tr>
<th>A. History</th>
<th>B. Theory</th>
<th>C. Environmental</th>
<th>D. Technics</th>
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<tbody>
<tr>
<td>ARCH372</td>
<td>ARCH352</td>
<td>ARCH350</td>
<td>ARCH318</td>
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<td>ARCH379</td>
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<tr>
<td>ARCH388</td>
<td>ARCH383</td>
<td>ARCH379</td>
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<td>ARCH522</td>
<td>ARCH524</td>
<td>ARCH520</td>
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<td>ARCH528</td>
<td>ARCH529</td>
<td>ARCH527</td>
<td>ARCH490</td>
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<tr>
<td>ARCH531</td>
<td>OCC1442</td>
<td>ARCH512</td>
<td>ARCH526</td>
</tr>
<tr>
<td>ARCH532</td>
<td>ARCH533</td>
<td>ARCH534</td>
<td></td>
</tr>
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</table>

OUTSIDE ELECTIVES 3
3 credits must be completed outside the School of Architecture, subject to approval by the Student adviser.

TOTAL CREDITS 97
### Architectural Complementaries

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
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<tbody>
<tr>
<td>ARCH252</td>
<td>(3) Introduction to Architectural History 1</td>
</tr>
<tr>
<td>ARCH253</td>
<td>(3) Introduction to Architectural History 2</td>
</tr>
<tr>
<td>ARCH319</td>
<td>(3) Design of the World Schl.</td>
</tr>
<tr>
<td>ARCH320</td>
<td>(3) The Camera and Perception</td>
</tr>
<tr>
<td>ARCH350</td>
<td>(3) The Material Culture of Canada</td>
</tr>
<tr>
<td>ARCH352</td>
<td>(3) Art and Theory of House Design</td>
</tr>
<tr>
<td>ARCH363</td>
<td>(2) Structure, Organization and Form</td>
</tr>
<tr>
<td>ARCH364</td>
<td>(2) Architectural Modeling</td>
</tr>
<tr>
<td>ARCH372</td>
<td>(2) History of Architecture in Canada</td>
</tr>
<tr>
<td>ARCH377</td>
<td>(2) Energy, Environment and Buildings</td>
</tr>
<tr>
<td>ARCH378</td>
<td>(3) Site Usage</td>
</tr>
<tr>
<td>ARCH379</td>
<td>(4) Summer Course Abroad</td>
</tr>
<tr>
<td>ARCH383</td>
<td>(3) Geometry/Architecture/Environment</td>
</tr>
<tr>
<td>ARCH388</td>
<td>(2) Introduction to Historic Preservation</td>
</tr>
<tr>
<td>ARCH461</td>
<td>(1) Freehand Drawing and Sketching</td>
</tr>
<tr>
<td>ARCH471</td>
<td>(2) Computer-Aided Building Design</td>
</tr>
<tr>
<td>ARCH490</td>
<td>(2) Selected Topics in Design</td>
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<tr>
<td>ARCH512</td>
<td>(3) Architectural Modelling</td>
</tr>
<tr>
<td>ARCH520</td>
<td>(3) Montreal: Urban Morphology</td>
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<td>ARCH521</td>
<td>(3) Structure of Cities</td>
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<td>ARCH522</td>
<td>(3) History of Domestic Architecture in Quebec</td>
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<td>ARCH523</td>
<td>(3) Significant Texts and Buildings</td>
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<tr>
<td>ARCH524</td>
<td>(3) Seminar on Architectural Criticism</td>
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<tr>
<td>ARCH525</td>
<td>(3) Seminar on Analysis and Theory</td>
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<tr>
<td>ARCH526</td>
<td>(3) Philosophy of Structure</td>
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<tr>
<td>ARCH527</td>
<td>(3) Civic Design</td>
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<tr>
<td>ARCH528</td>
<td>(3) History of Housing</td>
</tr>
<tr>
<td>ARCH529</td>
<td>(3) Housing Theory</td>
</tr>
<tr>
<td>ARCH531</td>
<td>(3) Architectural Intentions Vitruvius - Renaissance</td>
</tr>
<tr>
<td>ARCH532</td>
<td>(3) Origins of Modern Architecture</td>
</tr>
<tr>
<td>ARCH533</td>
<td>(3) New Approaches to Architectural History</td>
</tr>
<tr>
<td>ARCH534</td>
<td>(3) Architectural Archives</td>
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<tr>
<td>ARCH540</td>
<td>(3) Selected Topics in Architecture 1</td>
</tr>
<tr>
<td>ARCH541</td>
<td>(3) Selected Topics in Architecture 2</td>
</tr>
<tr>
<td>OCC1442</td>
<td>(2) Enabling Environments</td>
</tr>
</tbody>
</table>

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### 8.4.2 Department of Chemical Engineering

M.H. Wong Building, Room 3060
3610 University Street
Montreal, QC H3A 2B2

Telephone: (514) 398-4494
Fax: (514) 398-6678
Website: [www.mcgill.ca/chemeng](http://www.mcgill.ca/chemeng)

Chair — Dimitrios Berk

**Emeritus Professors**

John M. Dealy; B.S.(Kansas), M.S.E., Ph.D.(Mich.), Eng.
Musa R. Kamal; B.S.(Ill.) M.S., Ph.D.(Carnegie Mellon), Eng.
Juan H. Vera; B.Mat.(Chile), Ing.Quim.(U.T.E.), M.S.(Berkeley), Dr.Ing.(Santa Maria), Ing.

**Professors**

David G. Cooper; B.Sc., Ph.D.(Tor.)
Richard J. Munz; B.A.Sc., M.A.Sc.(Wat.), Ph.D.(McG.), Eng.
Alejandro D. Rey; B.Ch.Eng.(CCNY), Ph.D.(Berkeley) (James McGill Professor)

**Associate Professors**

Dimitrios Berk; B.Sc.(Bosphorus), M.E.Sc.(W.Ont.), Ph.D.(Calig.), P.Eng.
Jean-Luc Meunier; Dipl. Ing., EPFL(Lausanne), M.Sc., Ph.D., INRS(Varennes), Ing.

**Assistant Professors**

Sylvain Coulombe; B.Sc., M.Sc.A.(Sherb.), Ph.D.(McG.)
Reghan James Hill; B.Eng., Ph.D.(Cornell)
Richard L. Leask; B.A.Sc., M.A.Sc.(Wat.), Ph.D.(Tor.)
Corey Leclerc; B.Sc., Ph.D.(Minnesota)
Milan Maric; B.Sc., B.Eng.& Mgmt(McMaster), Ph.D.(Minnesota)

Sasha Omanovic; B.Sc., Ph.D.(Zagreb)
Phyllis Service; B.Sc., Ph.D.(Minnesota)
Nathalie Tufenkji; B.Eng.(McG.), M.Sc., Ph.D.(Yale)
Viviane Yargeau; B.Eng., M.Sc.A., Ph.D.(Sherbrooke)

**Post-Retirement**

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

**PAPRICAN Adjunct Professor**

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

**Adjunct Professors**


The central purpose of engineering is to pursue solutions to technological problems in order to satisfy the needs and desires of society. Chemical engineers are trained to solve the kinds of problems that are typically found in the "chemical process industries", which include the chemical manufacturing, plastics, water treatment, pulp and paper, petroleum refining, ceramics, and paint industries as well as substantial portions of the food processing, textile, nuclear energy, biochemical and pharmaceutical industries. The technological problems and opportunities in these industries are often closely linked to social, economic and environmental concerns. For this reason, practitioners of chemical engineering often deal with these questions when they are working in management, pollution abatement, product development, marketing and equipment design.

The discipline of chemical engineering is distinctive in being based equally on physics, mathematics and chemistry. Application of these three fundamental sciences is basic to a quantitative understanding of the process industries. Those with an interest in the fourth major science, biology, will find several courses in the chemical engineering curriculum which integrate aspects of the biological sciences relevant to process industries such as food processing, fermentation 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 practicing design engineers. Problem-solving, experimentation, planning and communication skills are emphasized in courses throughout the core curriculum. By means of complementary courses, students can also obtain further depth in technical areas and breadth in non-technical subjects. Some students elect to complete a minor in biotechnology, management, materials engineering, computer science, environmental engineering or chemistry.

The solution to many environmental problems requires an understanding of technological principles. A chemical engineering degree provides an ideal background. In addition to relevant material learned in the core program, a selection of environmental complementary courses and minor programs is available. The involvement of many chemical engineering staff members in environmental research provides the opportunity for undergraduate students to carry out research projects in this area.

The curriculum also provides the preparation necessary to undertake postgraduate studies leading to the M.Eng. or Ph.D. degrees in chemical engineering. Students completing this curriculum acquire a broad, balanced education in the natural sciences with the accent on application. Thus, for those who do not continue in chemical engineering, it provides an exceptionally balanced education in applied science. For others, it will form the basis of an educational program that may continue with a variety of studies such as business administration, medicine or law. Versatility is, then, one of the most valuable characteristics of the graduate of the chemical engineering program.

**ACADEMIC PROGRAM**

For those who have completed the Quebec CEGEP-level program in Pure and Applied Sciences, the Chemical Engineering Program comprises 111 credits as outlined below. Certain students who take advantage of summer session courses can complete the departmental programs in three calendar years. Students who have passed Chemistry 202 or 302 at the CEGEP level may be
exempt from course CHEM212 or CHEM234, respectively (Intro-
ductory Organic Chemistry 1 and Selected Topics in Organic
Chemistry), the corresponding courses are transferred from
required courses to electives.

For appropriately qualified high school graduates from outside
Quebec, an extended credit program is available, as described in
section 8.3.1.2 "Basic Science Requirements for Students Enter-
ing from Outside Quebec".

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

Students must obtain a C grade 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
complementary courses (departmental). A grade of "D" is a pass-
ning grade in other complementary courses and in any elective
courses taken.

### CURRICULUM FOR THE B.ENG. DEGREE IN CHEMICAL
ENGINEERING

#### REQUIRED COURSES

<table>
<thead>
<tr>
<th>COURSE</th>
<th>CREDIT</th>
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<tbody>
<tr>
<td>CHEE200 Introduction to Chemical Engineering</td>
<td>4</td>
</tr>
<tr>
<td>CHEE212 Introductory Organic Chemistry 1</td>
<td>4</td>
</tr>
<tr>
<td>CHEE233 Topics in Physical Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHEE234 Topics in Organic Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>COMP208 Computers in Engineering</td>
<td>3</td>
</tr>
<tr>
<td>MATH252 Intermediate Calculus</td>
<td>3</td>
</tr>
<tr>
<td>MATH253 Ordinary Differential Equations and Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>MATH264 Advanced Calculus</td>
<td>3</td>
</tr>
<tr>
<td>MIME221 Engineering Professional Practice</td>
<td>2</td>
</tr>
<tr>
<td>MIME310 Engineering Economy</td>
<td>3</td>
</tr>
<tr>
<td>MIME310 Engineering Economy</td>
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#### Chemical Engineering Courses

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<thead>
<tr>
<th>COURSE</th>
<th>CREDIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEE200 Introduction to Chemical Engineering</td>
<td>4</td>
</tr>
<tr>
<td>CHEE204 Chemical Manufacturing Processes</td>
<td>3</td>
</tr>
<tr>
<td>CHEE220 Chemical EngineeringThermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>CHEE291 Instrumental Measurements Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>CHEE314 Fluid Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>CHEE315 Heat and Mass Transfer</td>
<td>4</td>
</tr>
<tr>
<td>CHEE340 Process Modelling</td>
<td>3</td>
</tr>
<tr>
<td>CHEE351 Separation Processes</td>
<td>3</td>
</tr>
<tr>
<td>CHEE360 Technical Paper 1</td>
<td>1</td>
</tr>
<tr>
<td>CHEE370 Elements of Biotechnology</td>
<td>3</td>
</tr>
<tr>
<td>CHEE380 Materials Science</td>
<td>3</td>
</tr>
<tr>
<td>CHEE392 Project Laboratory 1</td>
<td>4</td>
</tr>
<tr>
<td>CHEE393 Project Laboratory 2</td>
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<tr>
<td>CHEE423 Chemical Reaction Engineering</td>
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<tr>
<td>CHEE435 Process Design</td>
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<tr>
<td>CHEE455 Process Control</td>
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</tr>
<tr>
<td>CHEE456 Project 1</td>
<td>1</td>
</tr>
<tr>
<td>CHEE457 Design Project 2</td>
<td>5</td>
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<tr>
<td>CHEE462 Technical Paper 2</td>
<td>1</td>
</tr>
<tr>
<td>CHEE474 Biochemical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CHEE483 Materials Engineering</td>
<td>3</td>
</tr>
</tbody>
</table>

#### COMPLEMENTARY COURSES

Courses to be selected from those approved by the
Department (see list of technical complementaries
below).

Two courses (6 credits), selected from an approved list:

- one course on the impact of technology on society and
- one in the humanities and social sciences,

administrative studies and law. See section 8.3.4
“Complementary Studies” for further information.

**TOTAL**

For students starting their B.Eng. studies in September who have
completed the Québec Diploma of Collegial Studies, a program for
the first two terms of study is given below:

<table>
<thead>
<tr>
<th>COURSE</th>
<th>CREDIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEE200 Introduction to Chemical Engineering</td>
<td>4</td>
</tr>
<tr>
<td>CHEE291 Instrumental Measurement Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>CHEE212 Introductory Organic Chemistry 1</td>
<td>4</td>
</tr>
<tr>
<td>MATH252 Intermediate Calculus</td>
<td>3</td>
</tr>
<tr>
<td>MIME221 Engineering Professional Practice</td>
<td>2</td>
</tr>
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**Term 1**

<table>
<thead>
<tr>
<th>COURSE</th>
<th>CREDIT</th>
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<tbody>
<tr>
<td>CHEE204 Chemical Manufacturing Processes</td>
<td>3</td>
</tr>
<tr>
<td>CHEE220 Chemical EngineeringThermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>CHEE234 Topics in Organic Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>COMP208 Computers in Engineering</td>
<td>3</td>
</tr>
<tr>
<td>MATH253 Ordinary Differential Equations and Linear Algebra</td>
<td>3</td>
</tr>
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</table>

**Term 2**

<table>
<thead>
<tr>
<th>COURSE</th>
<th>CREDIT</th>
</tr>
</thead>
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<tr>
<td>BIOT505 Selected Topics in Biotechnology</td>
<td>15</td>
</tr>
<tr>
<td>CHEE363 Projects Chemical Engineering 1</td>
<td>3</td>
</tr>
<tr>
<td>CHEE438 Engineering Principles in Pulp and Paper Processes</td>
<td>3</td>
</tr>
<tr>
<td>CHEE452 Particulate Systems</td>
<td>1</td>
</tr>
<tr>
<td>CHEE458 Computer Applications</td>
<td>1</td>
</tr>
<tr>
<td>CHEE464 Projects in Chemical Engineering 2</td>
<td>1</td>
</tr>
<tr>
<td>CHEE471 Industrial Water Pollution Control (or CIVE430)</td>
<td>1</td>
</tr>
<tr>
<td>CHEE472 Industrial Air Pollution Control (or MECH534)</td>
<td>1</td>
</tr>
<tr>
<td>CHEE481 Polymer Engineering</td>
<td>1</td>
</tr>
<tr>
<td>CHEE487 Chemical Processing Electronics Industry</td>
<td>1</td>
</tr>
<tr>
<td>CHEE489 Electrochemical Engineering</td>
<td>1</td>
</tr>
<tr>
<td>CHEE494 Research Project and Seminar</td>
<td>1</td>
</tr>
<tr>
<td>CHEE495 Research Project and Seminar</td>
<td>1</td>
</tr>
<tr>
<td>CHEE571 Small Computer Applications: Chemical Engineering</td>
<td>1</td>
</tr>
<tr>
<td>CHEE581 Polymer Composites Engineering</td>
<td>1</td>
</tr>
<tr>
<td>CHEE681 to CHEE684</td>
<td>1</td>
</tr>
</tbody>
</table>

Courses CHEE481 and CHEE581 comprise a Polymeric Materi-
als sequence. Additional courses in this area are available in the
Chemistry Department (e.g., CHEM455) or at the graduate level
(CHEE681 to CHEE684). The Department has considerable
expertise in the polymer area.

Courses CHEE370 and CHEE474 make up a sequence in Bio-
chemical Engineering-Biotechnology. Students interested in this
area may take additional courses, particularly those offered by the
Department of Food Science and Agricultural Chemistry, Faculty
of Agricultural and Environmental Sciences, and courses in bio-
chemistry and microbiology. The food, beverage and pharmaceu-
tical industries are large industries in the Montreal area and these
courses are relevant to these industries and to the new
high-technology applications of biotechnology.

The third area in which there is a sequence of courses is
Pollution Control. The Department offers two courses in this area:
CHEE471 and CHEE472. As some water pollution control prob-
lems are solved by microbial processes, course CHEE474 is also
relevant to the pollution control area. Likewise, as the solution to
pollution problems frequently involves removal of particulate mat-
ter from gaseous or liquid streams, course CHEE452 is also rele-

**Additional information can be found on the Faculty Website at
www.mcgill.ca/engineering, as well as in section 8.3.1.2 “Ba-
sic Science Requirements for Students Entering from Outside
Quebec”.**

### TECHNICAL COMPLEMENTARIES

A minimum of 9 credits of complementary courses must be chosen
from a list of technical complementaries approved by the Depart-
ment. The purpose of this requirement is to provide students with
an area of specialization within the broad field of chemical engi-
neering. Alternatively, some students use the technical comple-
mentaries to increase the breadth of their chemical engineering
training.

At least two (2) technical complementary courses are to be
selected from those offered by the Department (list below). Per-
mission is given to take the third complementary course from other
suitable undergraduate courses in the Faculty of Engineering.

The Technical Complementary courses currently approved by the
Department are as follows:

<table>
<thead>
<tr>
<th>COURSE</th>
<th>CREDIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOT505 Selected Topics in Biotechnology</td>
<td>15</td>
</tr>
<tr>
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<td>3</td>
</tr>
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<td>CHEE438 Engineering Principles in Pulp and Paper Processes</td>
<td>3</td>
</tr>
<tr>
<td>CHEE452 Particulate Systems</td>
<td>1</td>
</tr>
<tr>
<td>CHEE458 Computer Applications</td>
<td>1</td>
</tr>
<tr>
<td>CHEE464 Projects in Chemical Engineering 2</td>
<td>1</td>
</tr>
<tr>
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</tr>
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<tr>
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<tr>
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</tr>
<tr>
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</tr>
<tr>
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pollution problems frequently involves removal of particulate mat-
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SECTIONS 8.4.3 Department of Civil Engineering and AppliedMechanics

Macdonald Engineering Building, Room 492
817 Sherbrooke Street West
Montreal, QC H3A 2K6
Telephone: (514) 398-6860
Fax: (514) 398-7361
Website: www.mcgill.ca/civil

Chair — Denis Mitchell

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

Professors
Vincent H. Chu; B.S.Eng. (Taiwan), M.A.Sc. (Tor.), Ph.D. (M.I.T.), Eng.

James Nicell; B.A.Sc., M.A.Sc., Ph.D. (Windsor), P.Eng. (William Dawson Scholar)
Suresh C. Shrivastava; B.Sc. (Eng.) (Vikram), M.C.E. (Del.), Sc.D. (Col.), Eng.

Associate Professors
Susan J. Gaskin; B.Sc. (Queen’s), Ph.D. (Canterbury)
Ronald Gehl; B.Sc. (Eng.), Rand., M.A.Sc., Ph.D. (Tor.), P.Eng.
Subhasish Ghosal; B.C.E. (Jadavpur), M.S. (Missouri), Ph.D. (Carnegie Mellon)
Yixin Shao; B.S., M.S. (Tongji), Ph.D. (N.western)

Assistant Professors
Mohamed Abdel-Meguid; B.Sc (Azzhar), M.Sc., Ph.D. (Western)
Murtaza Haider; B.Sc. (Peshawar), M.A.Sc., Ph.D. (Tor.), (joint appoint. with School of Urban Planning)
Colin Rogers; B.A.Sc., M.A.Sc. (Waterloo), Ph.D. (Sydney), P.Eng.

Adjunct Professors

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

The program in Civil Engineering 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.

Students who wish to extend their knowledge in certain areas beyond the range that the program complementary courses allow can also take a Minor program. Minors are available in fields such as Arts, Economics, Management, Environmental Engineering, and Construction Engineering and Management. These require additional credits to be taken from a specified list of topics relating to the chosen field. Further information on the various Minor programs may be found in section 8.5 “Minor Programs and Choice of Electives or Complementary Courses”. Details of how the Minors
can be accommodated within the Civil Engineering program will be made available at the time of preregistration counselling.

**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 and Applied Mechanics. 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, and 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 adviser 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 adviser. 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 adviser.

**CURRICULUM FOR THE B.ENG. DEGREE IN CIVIL ENGINEERING**

<table>
<thead>
<tr>
<th>REQUIRED COURSES</th>
<th>COURSE CREDIT</th>
</tr>
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<tbody>
<tr>
<td><strong>Non-departmental courses</strong></td>
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<tr>
<td>COMP208  Computers in Engineering</td>
<td>3</td>
</tr>
<tr>
<td>EDEC206  Communication in Engineering</td>
<td>3</td>
</tr>
<tr>
<td>EPSC221  General Geology</td>
<td>3</td>
</tr>
<tr>
<td>MATH252  Intermediate Calculus</td>
<td>3</td>
</tr>
<tr>
<td>MATH263  Ordinary Differential Equations and Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>MATH264  Advanced Calculus</td>
<td>3</td>
</tr>
<tr>
<td>MECH261  Measurement Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>MECH289  Design Graphics</td>
<td>3</td>
</tr>
<tr>
<td>MIME221  Engineering Professional Practice</td>
<td>2</td>
</tr>
<tr>
<td>MIME310  Engineering Economy</td>
<td>3</td>
</tr>
<tr>
<td><strong>Departmental courses</strong></td>
<td></td>
</tr>
<tr>
<td>CIVE202  Construction Materials</td>
<td>4</td>
</tr>
<tr>
<td>CIVE205  Statics</td>
<td>3</td>
</tr>
<tr>
<td>CIVE206  Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>CIVE207  Solid Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>CIVE208  Civil Engineering Systems Analysis</td>
<td>3</td>
</tr>
<tr>
<td>CIVE210  Surveying</td>
<td>2</td>
</tr>
<tr>
<td>CIVE225  Environmental Engineering</td>
<td>4</td>
</tr>
<tr>
<td>CIVE290  Thermodynamics and Heat Transfer</td>
<td>3</td>
</tr>
<tr>
<td>CIVE302  Probabilistic Systems</td>
<td>3</td>
</tr>
<tr>
<td>CIVE311  Geotechnical Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>CIVE317  Structural Engineering 1</td>
<td>3</td>
</tr>
<tr>
<td>CIVE318  Structural Engineering 2</td>
<td>3</td>
</tr>
<tr>
<td>CIVE319  Transportation Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CIVE320  Numerical Methods</td>
<td>4</td>
</tr>
<tr>
<td>CIVE323  Hydrology and Water Resources</td>
<td>3</td>
</tr>
<tr>
<td>CIVE324  Construction Project Management</td>
<td>3</td>
</tr>
<tr>
<td>CIVE327  Fluid Mechanics and Hydraulics 1</td>
<td>4</td>
</tr>
<tr>
<td>CIVE418  Design Project</td>
<td>3</td>
</tr>
<tr>
<td>CIVE432  Technical Paper</td>
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</tr>
<tr>
<td><strong>COMPLEMENTARY COURSES</strong></td>
<td></td>
</tr>
<tr>
<td>A minimum of six credits to be selected from list (a) and the remaining nine credits to be selected from lists (a) or (b) or from other suitable undergraduate or 500-level courses.</td>
<td>15</td>
</tr>
<tr>
<td>(a) Design Technical Complementaries</td>
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<tr>
<td>CIVE416  Geotechnical Engineering</td>
<td>(3)</td>
</tr>
<tr>
<td>CIVE421  Municipal Systems</td>
<td>(3)</td>
</tr>
<tr>
<td>CIVE428  Water Resources and Hydraulic Engineering</td>
<td>(3)</td>
</tr>
<tr>
<td>CIVE430  Water Treatment and Pollution Control</td>
<td>(3)</td>
</tr>
<tr>
<td>CIVE462  Design of Steel Structures</td>
<td>(3)</td>
</tr>
<tr>
<td>CIVE463  Design of Concrete Structures</td>
<td>(3)</td>
</tr>
<tr>
<td>CIVE433  Urban Planning</td>
<td>(3)</td>
</tr>
<tr>
<td>CIVE440  Traffic Engineering</td>
<td>(3)</td>
</tr>
<tr>
<td>CIVE446  Construction Engineering</td>
<td>(3)</td>
</tr>
<tr>
<td>CIVE451  Geoenvironmental Engineering</td>
<td>(3)</td>
</tr>
<tr>
<td>CIVE460  Matrix Structural Analysis</td>
<td>(3)</td>
</tr>
<tr>
<td>CIVE470  Research Project</td>
<td>(3)</td>
</tr>
<tr>
<td>CIVE512  Advanced Civil Engineering Materials</td>
<td>(3)</td>
</tr>
<tr>
<td>CIVE514  Structural Mechanics</td>
<td>(3)</td>
</tr>
<tr>
<td>CIVE526  Solid Waste Management</td>
<td>(3)</td>
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<tr>
<td>CIVE527  Renovation and Preservation: Infrastructure</td>
<td>(3)</td>
</tr>
<tr>
<td>CIVE540  Urban Transportation Planning</td>
<td>(3)</td>
</tr>
<tr>
<td>CIVE541  Rail Engineering</td>
<td>(3)</td>
</tr>
<tr>
<td>CIVE550  Water Resources Management</td>
<td>(3)</td>
</tr>
<tr>
<td>CIVE553  Stream Pollution and Control</td>
<td>(3)</td>
</tr>
<tr>
<td>CIVE555  Environmental Data Analysis</td>
<td>(3)</td>
</tr>
<tr>
<td>CIVE570  Waves and Coastal Engineering</td>
<td>(3)</td>
</tr>
<tr>
<td>CIVE572  Computational Hydraulics</td>
<td>(3)</td>
</tr>
<tr>
<td>CIVE573  Hydraulic Structures</td>
<td>(3)</td>
</tr>
<tr>
<td>CIVE574  Fluid Mechanics of Water Pollution</td>
<td>(3)</td>
</tr>
<tr>
<td>CIVE576  Hydrodynamics</td>
<td>(3)</td>
</tr>
<tr>
<td>CIVE577  River Engineering</td>
<td>(3)</td>
</tr>
<tr>
<td>CIVE579  Water Power Engineering</td>
<td>(3)</td>
</tr>
<tr>
<td>CIVE585  Groundwater Hydrology</td>
<td>(3)</td>
</tr>
<tr>
<td>CIVE586  Earthwork Engineering</td>
<td>(3)</td>
</tr>
<tr>
<td>CIVE587  Pavement Design</td>
<td>(3)</td>
</tr>
</tbody>
</table>

**TOTAL CREDITS** 109

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**8.4.4 Department of Electrical and Computer Engineering**

Department of Electrical & Computer Engineering
Undergraduate Programs Office
Lorne Trotter Building, Room 2060
3630 University Street
Montreal, QC H3A 2B2
Telephone: (514) 398-3943
Fax: (514) 398-4653
Website: www.mcgill.ca/ece

Chair — David A. Lowther
Associate Chair, Undergraduate Studies — Jonathan P. Webb
Associate Chair, Graduate Studies — Benoit Champagne

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

Post-Retirement
Clifford H. Champness; M.Sc.(Lond.), Ph.D.(McG.)
The Department of Electrical and Computer Engineering offers undergraduate degree programs in Electrical Engineering, Electrical Engineering (Honours), Computer Engineering, and Software Engineering. All programs provide students with a strong background in mathematics, basic sciences, engineering science, engineering design and complementary studies, in conformity with the requirements of the Canadian Engineering Accreditation Board (CEAB).

The program in Electrical Engineering gives students a broad understanding of the key principles that are responsible for the extraordinary advances in the technology of computers, microelectronics, 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 all basic elements of electrical engineering and can function in any of our client industries. This breadth is what distinguishes an engineer from, say, a computer scientist or physicist.

The program in Electrical Engineering (Honours) is designed for students who wish to pursue postgraduate work and look to a career in advanced research and development. The technical complementaries are selected from graduate courses, facilitating the transition to postgraduate studies. Students in this curriculum benefit from smaller classes and have more contact with professional staff and graduate students. However, the program is quite demanding. Students are expected to register for at least 14 credits per term; they may register for a smaller number only with the permission of the Chair of this Department. Students in the Honours program must maintain a minimum GPA of 3.00. Those who fail to maintain this standard are transferred to the regular program.

The program in Computer Engineering 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.

The Department, jointly with the School of Computer Science, offers a Bachelor of Software Engineering program. Graduates of this program should be eligible for accreditation (once accreditation standards for Software Engineers have been adopted). This program offers students the opportunity to focus their studies on the skills needed to design and develop complex software systems. This emerging field of engineering is a major component of the growing Information Technology (IT) sector of the economy, in which the demand for qualified personnel continues to outstrip supply. Graduates of this program will have a solid foundation for careers in the software industry. The School of Computer Science offers a B.Sc. Major program in Software Engineering, which will not lead to accreditation. For further information on the B.Sc. program see section 12.12.8 ‘Computer Science (COMP)’. In addition to technical complementary courses, students in all three programs take general complementary courses in social sciences, administrative studies and humanities. These courses allow students to develop specific interests in areas such as psychology, economics, management or political science.

Entry into the Honours Program

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

- Students from CEGEP will be admitted, on the basis of their grades, at the start of the term.
- Students from outside Quebec will be admitted, on the basis of their grades, at the start of the third term.
- Students from outside Quebec will be admitted, on the basis of their grades, at the start of the fifth term.
Though not required to do so, students in the Honours program or wishing to enter the Honours program are encouraged to take the following advanced math and physics courses:

MATH325 Honours Ordinary Differential Equations
MATH247 Honours Linear Algebra
MATH248 Honours Advanced Calculus
MATH249 Honours Complex Variables
PHYS251 Classical Mechanics

To remain in the Honours program and to be awarded the Honours degree, a student must have completed at least 14 credits in each term since entering Electrical and Computer Engineering, except for the final two terms of their degree, and maintained a CGPA of at least 3.30 since entering Electrical and Computer Engineering. In either of their final two full terms (i.e., Fall and Winter, or Winter and Fall) students may drop below 14 credits, provided the combined load for the two terms is at least 16 credits. For more information, please contact the Departmental office at (514)398-7344.

**COURSES REQUIRED TO ENTER THE HONOURS PROGRAM**

**Departmental Courses**
- COMP202 Introduction to Computing 1
- EDEC206 Communication in Engineering
- MATH262 Intermediate Calculus
- MATH247 Honours Applied Linear Algebra
- MATH248 Honours Advanced Calculus
- PHYS221 Engineering Professional Practice
- PHYS231 Modern Physics
- EDEC310 Engineering Economy
- PHYS321 Classical Mechanics
- MATH249 Honours Complex Variables
- PHYS241 Analytical Mechanics
- MATH251 Linear Algebra and Partial Differential Equations
- MATH263 Ordinary Differential Equations and Linear Algebra

**Non-Departmental Courses**
- ECSE499 Honours Thesis 2
- ECSE498 Honours Thesis 1

To enter the Honours program, a student must complete at least 9 credits in one of the following specializations. However, with Departmental approval, the Honours Thesis 1 and 2 (ECSE498 and ECSE499) can count as 6 of the 9 credits. The remaining courses may be any at the 500 level offered by the Department. The choice is not restricted.

**COMPLEMENTARY COURSES**

**Technical Complementaries**

Five technical complementary courses (15 credits), which must be ECSE courses at the 500 level (or ECSE427, ECSE451). Students must choose their technical complementary courses so that they complete at least 9 credits in one of the following specializations. However, with Departmental approval, the Honours Thesis 1 and 2 (ECSE498 and ECSE499) can count as 6 of the 9 credits. The remaining courses may be any at the 500 level offered by the Department. The choice is not restricted.

**Computer Systems Technology**
- ECSE427 Operating Systems
- ECSE525 Computer Architecture
- ECSE532 Computer Graphics
- ECSE548 Introduction to VLSI Systems

**Control and Automation**
- ECSE501 Linear Systems
- ECSE502 Control Engineering
- ECSE503 Linear Stochastic Systems 1
- ECSE504 Computer Control
- ECSE505 Nonlinear Control Systems
- ECSE507 Optimization and Optimal Control
- ECSE509 Probability and Random Sig. 2
- ECSE512 Digital Signal Processing 1
- ECSE529 Image Processing and Communication
- ECSE531 Real Time Systems

**Integrated Circuits and Electronics**
- ECSE451 EM Transmission & Radiation
- ECSE522 Asynchronous Circuits and Systems
- ECSE527 Optical Engineering
- ECSE530 Logic Synthesis
- ECSE533 Physical Basis of Semiconductor Devices
- ECSE534 Analog Microelectronics
- ECSE536 RF Microelectronics
- ECSE545 Microelectronics Technology
- ECSE548 Introduction to VLSI Systems
- ECSE571 Optoelectronic Devices
- ECSE573 Microwave Electronics
- ECSE597 Circuit Simulators

**Power Engineering**
- ECSE502 Control Engineering
- ECSE549 Expert Systems in Electrical Design
- ECSE559 Flexible AC Transmission Systems
- ECSE560 Power Systems Analysis 2
- ECSE563 Power Systems Operation and Planning
- ECSE565 Introduction to Power Electronics

**Telecommunications**
- ECSE451 EM Transmission and Radiation
- ECSE509 Probability and Random Sig. 2
- ECSE511 Introduction to Digital Communication
- ECSE512 Digital Signal Processing 1
- ECSE521 Digital Communications 1
- ECSE523 Speech Communications
- ECSE527 Optical Engineering
- ECSE528 Telecommunication Network Architecture
- ECSE571 Optoelectronic Devices
- ECSE593 Antennas and Propagation
- ECSE596 Optical Waveguides

**Laboratory Complementaries**

Two of the following eleven 400-level laboratory courses:
- ECSE426 Microprocessor Systems
- ECSE431 Introduction to VLSI CAD
- ECSE435 Mixed-Signal Test Techniques
- ECSE436 Signal Processing Hardware
- ECSE485 IC Fabrication Laboratory
- ECSE486 Power Laboratory
- ECSE487 Computer Architecture Laboratory
- ECSE488 High Frequency Laboratory
- ECSE490 Digital Signal Processing Laboratory
- ECSE491 Communication Systems Laboratory
### CURRICULUM FOR THE B.ENG. DEGREE IN ELECTRICAL ENGINEERING (REGULAR)

<table>
<thead>
<tr>
<th>COURSE</th>
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<tr>
<td><strong>REQUIRED COURSES</strong></td>
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<tr>
<td><strong>Non-Departmental Courses</strong></td>
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<tr>
<td>CIVE281 Analytical Mechanics</td>
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<tr>
<td>or PHYS251 Classical Mechanics 1 (3)</td>
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<tr>
<td>COMP202 Introduction to Computing</td>
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<tr>
<td>EDEC206 Communication in Engineering</td>
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<tr>
<td>MATH262 Intermediate Calculus</td>
<td>3</td>
</tr>
<tr>
<td>MATH263 Ordinary Differential Equations and Linear Algebra</td>
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<tr>
<td>or MATH325 Honours Ordinary Differential Equations (3)</td>
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<tr>
<td>or MATH248 Honours Advanced Calculus (3)</td>
<td></td>
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<tr>
<td>or MATH271 Linear Algebra and Partial Differential Equations</td>
<td>3</td>
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<tr>
<td>or MATH247 Honours Applied Linear Algebra (3)</td>
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<td>MATH381 Complex Variables and Transforms</td>
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<td>MME221 Engineering Professional Practice</td>
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<td>MME310 Engineering Economy</td>
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<tr>
<td>PHYS271 Quantum Physics</td>
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</table>

* CGPA of 3.30 is required to register for MATH247 and MATH248.

<table>
<thead>
<tr>
<th>COURSE</th>
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<td><strong>Departmental Courses</strong></td>
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<tr>
<td>ECSE200 Fundamentals of Electrical Engineering</td>
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<tr>
<td>ECSE210 Circuit Analysis</td>
<td>3</td>
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<tr>
<td>ECSE221 Introduction to Computer Engineering</td>
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<tr>
<td>ECSE291 Electrical Measurements Laboratory</td>
<td>2</td>
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<tr>
<td>ECSE303 Signals and Systems 1</td>
<td>3</td>
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<tr>
<td>ECSE304 Signals and Systems 2</td>
<td>3</td>
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<tr>
<td>ECSE305 Probability and Random Sig.</td>
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<tr>
<td>ECSE322 Computer Engineering</td>
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<tr>
<td>ECSE323 Digital System Design</td>
<td>3</td>
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<tr>
<td>ECSE330 Introduction to Electronics (3)</td>
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<tr>
<td>or ECSE334 Introduction to Microelectronics</td>
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<tr>
<td>or ECSE351 Electromagnetic Fields</td>
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<tr>
<td>or ECSE352 EM Waves and Optics</td>
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<tr>
<td>or ECSE361 Power Engineering</td>
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<tr>
<td>or ECSE494 Electrical Engineering Design Project</td>
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</tr>
</tbody>
</table>

* Enhanced Power Concentration

Two courses (6 credits), selected from an approved list: one course on the impact of technology on society and one in the humanities and social sciences, administrative studies and law. See section 8.3.4 “Complementary Studies” for further information.

<table>
<thead>
<tr>
<th>COURSE</th>
<th>CREDIT</th>
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</thead>
<tbody>
<tr>
<td><strong>Laboratory Complementaries</strong></td>
<td></td>
</tr>
<tr>
<td>Two of the following eleven 400-level laboratory courses:</td>
<td></td>
</tr>
<tr>
<td>ECSE426 Microprocessor Systems</td>
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<tr>
<td>ECSE431 Introduction to VLSI CAD</td>
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<tr>
<td>ECSE435 Mixed-Signal Test Techniques</td>
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<tr>
<td>ECSE436 Signal Processing Hardware</td>
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<tr>
<td>ECSE485 IC Fabrication Laboratory</td>
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<td>ECSE486 Power Laboratory</td>
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<td>ECSE487 Computer Architecture Laboratory</td>
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<td>ECSE488 High Frequency Laboratory</td>
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<td>ECSE489 Telecommunication Network Lab</td>
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<tr>
<td>ECSE490 Digital Signal Processing Laboratory</td>
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<td>ECSE491 Communication Systems Laboratory</td>
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<td>ECSE492 Optical Communications Laboratory</td>
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<tr>
<td>ECSE493 Control and Robotics Laboratory</td>
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</tr>
</tbody>
</table>

**TOTAL CREDITS**

- 108

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### FACULTY OF ENGINEERING

- ECSE492 Optical Communications Laboratory
- ECSE493 Control and Robotics Laboratory
- ECSE494 Electrical Engineering Design Project
- ECSE491 Communication Systems Laboratory
- ECSE490 Digital Signal Processing Laboratory
- ECSE493 Control and Robotics Laboratory
- ECSE432 Physical Basis: Transistor Devices
- ECSE435 Mixed-Signal Test Techniques
- ECSE451 EM Transmission & Radiation
- ECSE423 Fundamentals of Photonics
- ECSE430 Photonic Devices and Systems
- ECSE432 Physical Basis: Transistor Devices

**Power Engineering**

- ECSE404 Control Systems
- ECSE460 Appareillage électrique (Electrical Power Equipment)
- ECSE462 Electromechanical Energy Conversion
- ECSE464 Power System Analysis 1
- ECSE465 Power Electronic Systems
- ECSE468 Electricité industrielle (Industrial Power Systems)
- ECSE441 Communications Systems 1
- ECSE444 Introduction to Telecommunication Networks

and any one of the following:

- ECSE405 Antennas
- ECSE412 Discrete Time Signal Processing
- ECSE413 Communications Systems 2
- ECSE423 Fundamentals of Photonics
- ECSE436 Signal Processing Hardware
- ECSE451 EM Transmission and Radiation

**Laboratory Complementaries**

- Two of the following eleven 400-level laboratory courses:
- ECSE426 Microprocessor Systems
- ECSE431 Introduction to VLSI CAD
- ECSE435 Mixed-Signal Test Techniques
- ECSE436 Signal Processing Hardware
- ECSE485 IC Fabrication Laboratory
- ECSE486 Power Laboratory
- ECSE487 Computer Architecture Laboratory
- ECSE488 High Frequency Laboratory
- ECSE489 Telecommunication Network Lab
- ECSE490 Digital Signal Processing Laboratory
- ECSE491 Communication Systems Laboratory
- ECSE492 Optical Communications Laboratory
- ECSE493 Control and Robotics Laboratory

**General Complementaries**

- Two courses (6 credits), selected from an approved list: one course on the impact of technology on society and one in the humanities and social sciences, administrative studies and law. See section 8.3.4 “Complementary Studies” for further information.

**TOTAL CREDITS**

- 108

**Enhanced Power Concentration**

The Institute for Electrical Power Engineering was recently established as a province-wide centre for electrical power engineering education. It is funded by industry, mostly Hydro-Québec, and provides a comprehensive program and state-of-the-art laboratory facilities, and a point of contact between industry and universities involved in power engineering. This program is open to students in the regular Electrical Engineering program only.

The benefits of the Concentration are:
- a complete and up-to-date final-year program in electrical power engineering, with industry-sponsored and supported courses;
- access to industry-sponsored projects, internships and new employment opportunities.

**Eligibility criteria:** To be considered in September 2005, the applicant must:

- be registered in the B.Eng. program (regular Electrical Engineering);
- have a cumulative GPA of at least 2.70;
**Enhanced ITT Specialization in Telecommunications**

The International Institute of Telecommunications (ITT) was established in Montreal as a centre for telecommunications education. Funded by government and industry, it provides state-of-the-art laboratory facilities and a point of contact between local telecommunications industries and universities.

This program is open to students in the regular Electrical Engineering program only.

The benefits of the specialization are:
- a guaranteed project lab (ECSE494) in telecommunications, at IIT or with an IIT company; and
- permission to take ECSE496 at IIT.

To complete the specialization, students must take six courses as Technical Complementaries:

- ECSE411 Communications Systems 1
- ECSE414 Introduction to Telecommunication Networks
- ECSE496 Telecommunications Systems and Services

and any three courses selected from the following list:

- ECSE412 Discrete Time Signal Processing
- ECSE413 Communications Systems 2
- ECSE423 Fundamentals of Photonics
- ECSE451 EM Transmission and Radiation

In addition, students must take ECSE491 (Communications Systems Lab) and complete ECSE494 (Electrical Engineering Design Project) in telecommunications, at IIT or with an IIT company.

There may be an enrolment limitation in this specialization in any given term.

**Enhanced ITT Specialization in Telecommunications**

**COMPLEMENTARY COURSES**

Technical Complementaries

Three courses (9 credits) selected from:

- ECSE404 Control Systems
- ECSE411 Communications Systems 1
- ECSE412 Discrete Time Signal Processing
- ECSE414 Introduction to Telecommunication Networks
- or COMP535 Computer Networks 1

or COMP535 Computer Networks 1

- ECSE421 Embedded Systems
- ECSE424 Human-Computer Interaction
- ECSE426 Microprocessor Systems
- ECSE428 Software Engineering Practice
- ECSE431 Introduction to VLSI CAD
- ECSE436 Signal Processing Hardware
- ECSE530 Logic Synthesis
- ECSE526 Artificial Intelligence
- ECSE531 Real Time Systems
- ECSE532 Computer Graphics
- ECSE548 Introduction to VLSI Systems
- COMP420 Files and Databases
- COMP431 Algorithms for Engineers
- COMP575 Fundamentals of Distributed Algorithms

Laboratory Complementaries

Two of the following 400-level laboratory courses:

- ECSE426 Microprocessor Systems
- ECSE431 Introduction to VLSI CAD
- ECSE435 Mixed-Signal Test Techniques
- ECSE436 Signal Processing Hardware
- ECSE487 Computer Architecture Laboratory
- ECSE489 Telecommunication Network Lab
- ECSE490 Digital Signal Processing Laboratory
- ECSE491 Communication Systems Laboratory
CURRICULUM FOR THE BACHELOR OF SOFTWARE ENGINEERING (B.S.E.)

REQUIRED COURSES

<table>
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<tr>
<th>COURSE</th>
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<td>COMP206</td>
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<td>COMP250</td>
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<td>MATH270</td>
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<td>MATH363</td>
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<tr>
<td>MATH381</td>
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Technical Complementaries

Students must take 11-12 credits of technical complementaries from the following list, of which at least 6 credits must be taken from list A and the remainder from list B.

Group A Technical Complementaries

<table>
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<tr>
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<tr>
<td>COMP350</td>
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<td>COMP409</td>
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Group B Technical Complementaries

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COMPLEMENTARIES

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<td>ECSE425</td>
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<td>or COMP573</td>
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<td>or COMP557</td>
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<td>COMP520</td>
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<td>COMP566</td>
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TOTAL CREDITS 108/6

8.4.5 Department of Mechanical Engineering

Macdonald Engineering Building, Room 351
817 Sherbrooke Street West
Montreal, QC H3A 2K6
Telephone: (514) 398-6296
Fax: (514) 398-7365
Website: www.mcgill.ca/mecheng

Chair — Arun K. Misra

Emeritus Professors

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

Post-Retirement

Glen Bach; B.Sc.(Alta.), M.Sc.(Birm.), Ph.D.(McG.)

Professors

Bantwal R. Baliga; B.Tech.(I.I.T., Kanpur), M.Sc.(Case), Ph.D.(Minnesota)
Martin Ostoj-Starzewski; Eng.(Karakow Tech.U.), M.Eng., Ph.D.(McG.), F.A.S.M.E., F.W.I.F. (Canada Research Chair) (Honours Program Coordinator)
Stuart J. Price; B.Sc., Ph.D.(Bristol), P.Eng.
Associate Professors
Luca Corteelzi; M.Sc., Ph.D.(Caltech)
David L. Frost; B.Sc.(U.B.C.), M.S., Ph.D.(Caltech), P.Eng.
Tim Lee; M.S.(Portland State), Ph.D.(Idaho)
Larry B. Lessard; B.Eng.(McG.), M.Sc., Ph.D.(Stanford), P.Eng.
(Graduate Program Coordinator)
Laurent Mydlarski; B.Sc.(Waterloo), Ph.D.(Cornell), Eng.
Meyer Nahon; B.Sc.(Queen’s), M.Sc.(Tor.), Ph.D.(McG.), P.Eng.
(Graduate Program Director)
James A. Nemes; B.Sc.(Maryland), M.S., D.Sc.(GWU), P.E.,
P.Eng. (William Dawson Scholar),
Peter Radziszewski; B.Sc.(UBC), M.Sc., Ph.D.(Laval)
Inna Sharf; B.Sc.(Tor.), Ph.D.(Tor.), P.Eng.
Vince Thomson; B.Sc.(Windsor), Ph.D.(McMaster) (Werner Grappe Professor of Manufacturing Automation)
F.C.S.M.E.

Assistant Professors
Andrew J. Higgins; B.Sc.(Ill.), M.S., Ph.D.(Wash.)
Pascal Hubert; B.Eng., M.Sc.(École Polytechnique),
Ph.D.(U.B.C.), P.Eng. (Canada Research Chair)
József Kövecses; M.Sc.(U. Miskolc), Ph.D.(Hung. Acad. Sci.),
P.Eng.
R. Mongrain; B.Sc., M.Sc.(Montr.), Ph.D.(École Polytechnique),
Eng.
Siva Nadarajah; B.Sc.(Math), B.Sc.(Aerospace Eng.)(Kansas),
M.Sc., Ph.D.(Stanford)
Damiano Pasini; M.Sc.(Pavia); Ph.D.(Bristol), P.Eng.
Srikar T. Vengalifatore; B.Tech(B.H.U.), Ph.D.(M.I.T.) (Canada Research Chair)

Laboratory Superintendents
A. Micozzi; G. Savard, G. Tewfik

Associate Members
R. E. Kearney; B. Eng., M. Eng., Ph.D.(McG.), Biomedical
Engineering Unit
B. H. K. Lee; B. Eng., M. Eng., Ph.D.(McG.)

Adjunct Professors
H. Attia; R.G. Edwards, S. Girgis, A. Hemami, Z. Liu,
K. Mackenzie, W.D. May, C.A. Rabbath, R. Sumner,
G.A.Wagner, T. Yee, D. Zorbas

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

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

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

Special interest is satisfied by selecting appropriate comple-
mentary courses from among those offered with a specific sub-
ject concentration, such as management, industrial engineering, aero-
nautics, combustion, systems engineering, etc.

The Department offers an Honours Program which is particu-
larly suitable for those with a high aptitude in mathematics and
physics and which gives a thorough grounding in the basic engi-
neering sciences. The complementary courses in this program can
be utilized to take courses with applied engineering orientation,
such as those offered in the regular program, or if preferred, to
obtain an even more advanced education in engineering science.

Concentrations in Aeronautical Engineering, Mechatronics and
Design are available for students in either the Regular or Honours
programs who wish to specialize in these areas.

While the program is demanding, there is time for many extra-
curricular activities. Students are active in such professional soci-
eties as CASI (Canadian Aeronautics and Space Institute), SAE
(Society of Automotive Engineers), and ASME (American Society
of Mechanical Engineers) and in various campus organizations.
Relations between faculty and students are extremely close. Social
functions, at which students and professors meet to exchange views and get to know each other better, are organized
frequently.

CURRICULUM FOR THE B.ENG. DEGREE IN MECHANICAL
ENGINEERING (REGULAR)

REQURED COURSES

Non-Departmental Subjects
CIVE207 Solid Mechanics
COMP208 Computers in Engineering
ECSE461 Electric Machinery
EDEC206 Communication in Engineering
MATH262 Intermediate Calculus
MATH263 Ordinary Differential Equations and
Linear Algebra
MATH264 Advanced Calculus
MATH271 Linear Algebra and Partial Differential
Equations
MIME221 Engineering Professional Practice
MIME260 Materials Science and Engineering
MIME310 Engineering Economy

Departmental Courses
MECH201 Introduction to Mechanical Engineering
MECH210 Mechanics 1
MECH220 Mechanics 2
MECH240 Thermodynamics 1
MECH260 Machine Tool Laboratory
MECH262 Statistics and Measurement Laboratory
MECH289 Design Graphics
MECH292 Design 1
MECH309 Numerical Methods in Mechanical
Engineering
MECH314 Dynamics of Mechanisms
MECH315 Mechanics 3
MECH321 Mechanics of Deformable Solids
MECH331 Fluid Mechanics 1
MECH341 Thermodynamics 2
MECH346 Heat Transfer
MECH362 Mechanical Laboratory 1
MECH383 Applied Electronics and Instrumentation
MECH393 Design 2
MECH412 Dynamics of Systems
MECH430 Fluid Mechanics 2
MECH463D1 Mechanical Engineering Project
MECH463D2 Mechanical Engineering Project

COMPLEMENTARY COURSES

2 courses (6 credits) at the 300 level or higher to be
selected from Mechanical Engineering. For students
who entered in September 2004 or later, one of these
two courses must be chosen from the following list:

MECH437 Value Engineering
MECH513 Control Engineering
MECH524 Computer Integrated Manufacturing
MECH526 Manufacturing and the Environment
MECH528 Product Design
MECH541 Kinematic Synthesis
MECH543 Design with Composite Materials
MECH554 Microprocessors for Mechanical Systems
MECH557 Mechatronic Design
MECH565 Fluid Flow and Heat Transfer Equipment
MECH573 Mechanics of Robotic Systems
MECH577 Optimum Design
1 course (3 credits) at the 300 level or higher from the Faculty of Engineering or an approved course in the Faculty of Science, including Mathematics.

Two courses (6 credits), selected from an approved list: one course on the impact of technology on society and one in the humanities and social sciences, administrative studies and law. See section 8.3.4 “Complementary Studies” for further information.

TOTAL CREDITS 112

Students entering in September or January must plan their program of studies in accordance with the regulations posted on the Faculty Website at www.mcgill.ca/engineering. After registering, students must consult with their academic adviser.

Additional information can be found in section 8.3.2 “Basic Science Requirements for Students Entering from Outside Quebec”.

CURRICULUM FOR THE B.ENG. DEGREE IN MECHANICAL ENGINEERING (HONOURS)

<table>
<thead>
<tr>
<th>COURSE</th>
<th>CREDIT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Non-Departmental Subjects</strong></td>
<td></td>
</tr>
<tr>
<td>CIVE207 Solid Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>EDEC206 Communication in Engineering</td>
<td>3</td>
</tr>
<tr>
<td>COMP208 Computers in Engineering</td>
<td>3</td>
</tr>
<tr>
<td>MATH262 Intermediate Calculus</td>
<td>3</td>
</tr>
<tr>
<td>MATH263 Ordinary Differential Equations and Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>MATH264 Advanced Calculus</td>
<td>3</td>
</tr>
<tr>
<td>MATH271 Linear Algebra and Partial Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>MIME221 Engineering Professional Practice</td>
<td>2</td>
</tr>
<tr>
<td>MIME310 Engineering Economy</td>
<td>3</td>
</tr>
<tr>
<td><strong>Departmental Courses</strong></td>
<td></td>
</tr>
<tr>
<td>MECH201 Introduction to Mechanical Engineering</td>
<td>2</td>
</tr>
<tr>
<td>MECH210 Mechanics 1</td>
<td>3</td>
</tr>
<tr>
<td>MECH220 Mechanics 2</td>
<td>4</td>
</tr>
<tr>
<td>MECH240 Thermodynamics 1</td>
<td>3</td>
</tr>
<tr>
<td>MECH260 Machine Tool Laboratory</td>
<td>3</td>
</tr>
<tr>
<td>MECH262 Statistics and Measurement Laboratory</td>
<td>3</td>
</tr>
<tr>
<td>MECH289 Design Graphics</td>
<td>3</td>
</tr>
<tr>
<td>MECH292 Design 1</td>
<td>3</td>
</tr>
<tr>
<td>MECH309 Numerical Methods in Mechanical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>MECH321 Mechanics of Deformable Solids</td>
<td>3</td>
</tr>
<tr>
<td>MECH331 Fluid Mechanics 1</td>
<td>3</td>
</tr>
<tr>
<td>MECH341 Thermodynamics 2</td>
<td>3</td>
</tr>
<tr>
<td>MECH346 Heat Transfer</td>
<td>3</td>
</tr>
<tr>
<td>MECH362 Mechanical Laboratory 1</td>
<td>2</td>
</tr>
<tr>
<td>MECH383 Applied Electronics and Instrumentation</td>
<td>3</td>
</tr>
<tr>
<td>MECH403D1 Thesis (Honours)</td>
<td>3</td>
</tr>
<tr>
<td>MECH403D2 Thesis (Honours)</td>
<td>3</td>
</tr>
<tr>
<td>MECH404 Honours Thesis 2</td>
<td>3</td>
</tr>
<tr>
<td>MECH419 Advanced Mechanics of Systems</td>
<td>4</td>
</tr>
<tr>
<td>MECH430 Fluid Mechanics 2</td>
<td>3</td>
</tr>
<tr>
<td>MECH452 Mathematical Methods in Engineering 1</td>
<td>3</td>
</tr>
<tr>
<td>MECH494 Honours Design Project</td>
<td>3</td>
</tr>
<tr>
<td><strong>COMPLEMENTARY COURSES</strong></td>
<td>21</td>
</tr>
<tr>
<td>2 of the following three courses (6 credits):</td>
<td></td>
</tr>
<tr>
<td>MECH545 Advanced Stress Analysis</td>
<td></td>
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<tr>
<td>MECH562 Advanced Fluid Mechanics</td>
<td></td>
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<tr>
<td>MECH578 Advanced Thermodynamics</td>
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<tr>
<td>2 courses (6 credits) at the 300 level or higher to be selected from Mechanical Engineering. For students who entered in September 2004 or later, one of these two courses must be chosen from the following list:</td>
<td></td>
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<tr>
<td>MECH497 Value Engineering</td>
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<tr>
<td>MECH513 Control Systems</td>
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<tr>
<td>MECH524 Computer Integrated Manufacturing</td>
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<tr>
<td>MECH526 Manufacturing and the Environment</td>
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<tr>
<td>MECH528 Product Design</td>
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<tr>
<td>MECH541 Kinematic Synthesis</td>
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<tr>
<td>MECH543 Design with Composite Materials</td>
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<tr>
<td>MECH554 Microprocessors for Mechanical Systems</td>
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<tr>
<td>MECH557 Mechatronic Design</td>
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<tr>
<td>MECH565 Fluid Flow and Heat Transfer Equipment</td>
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<tr>
<td>MECH573 Mechanics of Robotic Systems</td>
<td></td>
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<tr>
<td>MECH576 Computer Graphics and Geometrical Modelling</td>
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<tr>
<td>MECH577 Optimum Design</td>
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<tr>
<td>MECH578 Advanced Thermodynamics</td>
<td></td>
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<tr>
<td>MECH581 Nonlinear Dynamics and Chaos</td>
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</tbody>
</table>

TOTAL CREDITS 112

Students entering in September or January must plan their program of studies in accordance with the regulations posted on the Faculty Website at www.mcgill.ca/engineering. After registering, students must consult with their academic adviser.

Additional information can be found in section 8.3.2 “Basic Science Requirements for Students Entering from Outside Quebec”.

LIST OF COMPLEMENTARY COURSES (DEPARTMENTAL) (Each is 3 credits)

<table>
<thead>
<tr>
<th>COURSE</th>
<th>CREDIT</th>
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<tbody>
<tr>
<td>MECH343 Energy Conversion</td>
<td></td>
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<tr>
<td>MECH413 Control Systems</td>
<td></td>
</tr>
<tr>
<td>MECH432 Aircraft Structures</td>
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<tr>
<td>MECH434 Turbomachinery</td>
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<tr>
<td>MECH447 Combustion</td>
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<tr>
<td>MECH471 Industrial Engineering</td>
<td></td>
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<tr>
<td>MECH472 Case Studies in Project Mgmt</td>
<td></td>
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<tr>
<td>MECH474 Selected Topics in Operations Research</td>
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<tr>
<td>MECH495 Design 3</td>
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<tr>
<td>MECH496 Design 4</td>
<td></td>
</tr>
<tr>
<td>MECH497 Value Engineering</td>
<td></td>
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<tr>
<td>MECH500 Selected Topics in Mechanical Engineering</td>
<td></td>
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<tr>
<td>MECH501 Special Topics: Mechanical Engineering</td>
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<tr>
<td>MECH522 Production Systems</td>
<td></td>
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<tr>
<td>MECH524 Computer Integrated Manufacturing</td>
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<tr>
<td>MECH526 Manufacturing and the Environment</td>
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<tr>
<td>MECH528 Product Design</td>
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<tr>
<td>MECH529 Discrete Manufacturing Systems</td>
<td></td>
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<tr>
<td>MECH530 Mechanics of Composite Materials</td>
<td></td>
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<tr>
<td>MECH531 Aeronautics</td>
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<tr>
<td>MECH532 Aircraft Performance, Stability and Control</td>
<td></td>
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<tr>
<td>MECH533 Subsonic Aerodynamics</td>
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<tr>
<td>MECH534 Air Pollution Engineering</td>
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<tr>
<td>MECH537 High-Speed Aerodynamics</td>
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<tr>
<td>MECH538 Unsteady Aerodynamics</td>
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<tr>
<td>MECH539 Computational Aerodynamics</td>
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<tr>
<td>MECH540 Design: Modelling and Decision</td>
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<tr>
<td>MECH541 Kinematic Synthesis</td>
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<tr>
<td>MECH542 Spacecraft Dynamics</td>
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<tr>
<td>MECH543 Design with Composite Materials</td>
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<tr>
<td>MECH545 Advanced Stress Analysis</td>
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<tr>
<td>MECH552 Advanced Applied Mathematics</td>
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<tr>
<td>MECH554 Microprocessors for Mechanical Systems</td>
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<tr>
<td>MECH555 Applied Process Control</td>
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<tr>
<td>MECH557 Mechatronic Design</td>
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<tr>
<td>MECH561 Biomechanics of Musculoskeletal Systems</td>
<td></td>
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<tr>
<td>MECH562 Advanced Fluid Mechanics</td>
<td></td>
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<tr>
<td>MECH565 Fluid Flow and Heat Transfer Equipment</td>
<td></td>
</tr>
<tr>
<td>MECH572 Introduction to Robotics</td>
<td></td>
</tr>
<tr>
<td>MECH573 Mechanics of Robotic Systems</td>
<td></td>
</tr>
<tr>
<td>MECH576 Computer Graphics and Geometrical Modelling</td>
<td></td>
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<tr>
<td>MECH577 Optimum Design</td>
<td></td>
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<tr>
<td>MECH578 Advanced Thermodynamics</td>
<td></td>
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<tr>
<td>MECH581 Nonlinear Dynamics and Chaos</td>
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</tr>
</tbody>
</table>
TYPICAL PROGRAM OF STUDIES FOR REGULAR OR HONOURS

For students starting their B.Eng. studies in September 2004 who have completed the Quebec Diploma of Collegial Studies, a program for the first two terms of study is given below. Students will be advised by the Department whether they should follow Stream A or Stream B.

STREAM A:

Term 1 (Fall)
- COMP208 Computers in Engineering
- MATH262 Intermediate Calculus
- MECH201 Introduction to Mechanical Engineering
- MECH210 Mechanics 1
- MECH260 Machine Tool Laboratory
- MIME221 Engineering Professional Practice

Term 2 (Winter)
- MATH263 Differential Equations
- MATH264 Advanced Calculus
- MECH220 Mechanics 2
- MECH262 Statistics and Measurement Laboratory
- MECH291 Graphics

STREAM B:

Term 1 (Fall)
- COMP208 Computers in Engineering
- MATH262 Intermediate Calculus
- MECH201 Introduction to Mechanical Engineering
- MECH260 Machine Tool Laboratory
- MECH291 Graphics
- MIME221 Engineering Professional Practice

Term 2 (Winter)
- MATH263 Differential Equations
- MATH264 Advanced Calculus
- MECH210 Mechanics 1
- MECH262 Statistics and Measurement Laboratory
- MIME260 Materials Science and Engineering
- MECH291 Graphics

For all Minors and Concentrations, students should complete a special form available from the Undergraduate Program Secretary indicating their intention to take the Minor or the Concentration.

AERONAUTICAL ENGINEERING CONCENTRATION

Students in this Concentration should take five courses in the area of Aeronautical Engineering.

Required Courses (6 credits):
- MECH532 (3) Aircraft Performance, Stability and Control
- MECH533 (3) Subsonic Aerodynamics

Complementary Courses (9 credits)
at least one of the following two courses:
- MECH432 (3) Aircraft Structures
- MECH434 (3) Turbomachinery

the remaining two courses may be chosen from the above or from the following courses:
- MECH531 (3) Aerelasticity
- MECH537 (3) High-Speed Aerodynamics
- MECH538 (3) Unsteady Aerodynamics
- MECH539 (3) Computational Aerodynamics
- MECH556 (3) Fluid Flow and Heat Transfer Equipment

All courses must be passed at a level C or better.

Students should also discuss the matter with their adviser and complete a special form indicating their intention to take this Concentration.

DESIGN CONCENTRATION

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

Of the five courses, two are required:
- MECH498 Interdisciplinary Design Project 1

MECH499 Interdisciplinary Design Project 2

The remaining three courses are to be chosen from the list below:
- ABEN412 Machinery Systems Engineering
- ARCH515 Sustainable Design
- CHEE453 Process Design
- MECH497 Value Engineering
- MECH526 Manufacturing and the Environment
- MECH528 Product Design
- MECH530 Mechanics of Composite Materials
- MECH541 Kinematic Synthesis
- MECH453 Design with Composite Materials
- MECH554 Microprocessors for Mechanical Systems
- MECH557 Mechatronics Design
- MECH565 Fluid Flow and Heat Transfer Equipment
- MECH576 Computer Graphics and Geometric Modeling
- MECH577 Optimum Design
- MECH583 Design Principles

MECHATRONICS CONCENTRATION

Students in this Concentration should take six courses in the area of Control, Robotics and/or CAD/CAM. They must take the following four required courses:
- MECH513 Control Systems
- MECH554 Microprocessors for Mechanical Systems
- MECH557 Mechatronic Design
- MECH572 Introduction to Robotics

and two of the following:
- MECH528 Product Design
- MECH541 Kinematic Synthesis
- MECH573 Mechanics of Robotic Systems
- MECH576 Computer Graphics and Geometrical Modelling

8.4.6 Department of Mining, Metals and Materials Engineering

Wong Building, Room 2160
3610 University Street
Montreal, QC H3A 2B2
Website: www.mcgill.ca/minmet

Metals and Materials –
Telephone: (514) 398-1040 Fax: (514) 398-4492

Mining –
Telephone: (514) 398-2215 Fax: (514) 398-7099

Chair — Robin A.L. Drew

Emeritus Professors
John E. Gruzleski; B.Sc., M.Sc.(Qu.), Ph.D.(Tor.), Eng., (Gerald G. Hatch Emeritus Professor of Mining and Metallurgy)
William M. Williams; B.Sc., M.Sc.(Brist.), Ph.D.(Tor.), Eng. (Henry Birks Emeritus Professor of Metallurgy)

Professors
Roussos Dimitrakopoulos; B.Sc.m M.Sc.(Alta.), Ph.D.(Ecole Poly., Montr.)
George P. Damopoulos; Dipl. Eng.(NTU Athens), M.Sc., Ph.D.(McG.), Eng.
Robin A.L. Drew; B.Tech.(Bradford), Ph.D.(Newcastle)
James A. Finch; B.Sc.(Birm.), M.Eng., Ph.D.(McG.), Eng. (Industry Professor of Mineral Processing)
Raynald Gauvin; B.Eng., Ph.D.(Montr.), Eng.
Rod I.L. Guthrie; B.Sc., Ph.D.(Lond.), D.I.C., A.R.S.M., Eng. (William C. Macdonald Emeritus Professor of Mining and Metallurgy)
Ralph Harris; B.Sc.(Qld), M.Eng., Ph.D.(McG.)
Faramarz (Ferri) P. Hassani; Ph.D.(Nott.), MIMMM (George Boyd Webster Emeritus Professor of Mining Engineering) (Director, Mining Engineering Program)
Hani S. Mitri; B.Sc.(Cairo), M.Eng., Ph.D.(McMaster), Eng.
Jerzy Szpunar; B.Sc., M.Sc., Ph.D., D.Sc.(Krakow)
Steve Yue; B.Sc., Ph.D.(Leeds)
tion deadlines or else late fees will apply.

Students must register for each of the above-mentioned industrial training courses related to the operation of the CO-OP program. Students in good standing are eligible to undertake up to two formal industrial work periods. It is built around a strong background of mathematics, basic sciences, computer skills and applications, and specific engineering and design courses to provide up-to-date training in materials engineering. Students take core courses covering processing, fabrication, applications and performance of materials, namely metals, ceramics, polymers and composites. The program conforms to requirements of the Canadian Engineering Accreditation Board (CEAB) and is designed to offer students the best training for employment in the field. The basic 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 which include the resource and manufacturing sectors. Students in the CO-OP program benefit from the practical learning experience arising from work-term employment in meaningful engineering jobs. Students also benefit from the non-tangible learning experience arising from the increased responsibilities required to obtain and successfully complete the work terms.

Students pay a two-credit course fee for each of the following courses covering processing, fabrication, applications and performance of materials, namely metals, ceramics, polymers and composites. The program conforms to requirements of the Canadian Engineering Accreditation Board (CEAB) and is designed to offer students the best training for employment in the field. The basic 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 which include the resource and manufacturing sectors. Students in the CO-OP program benefit from the practical learning experience arising from work-term employment in meaningful engineering jobs. Students also benefit from the non-tangible learning experience arising from the increased responsibilities required to obtain and successfully complete the work terms.

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COMPLEMENTARY COURSES

Technical Courses: 12 credits
- CHEE581 (3) Polymer Composites Engineering
- GIVE512 (3) Advanced Civil Engineering Materials
- MECH530 (3) Mechanics of Composite Materials
- MIME410 (3) Research Project
- MIME412 (3) Corrosion and Degradation
- MIME451 (3) Environmental Controls: Met’l Plants
- MIME456 (3) Steelmaking & Steel Processing
- MIME457 (3) Light Metals Extraction and Processing
- MIME463 (3) Deformation Processing of Metals
- MIME515 (3) Advanced Metallurgical and Materials Thermodynamics
- MIME544 (3) Analysis: Mineral Processing Systems 1
- MIME545 (3) Analysis: Mineral Processing Systems 2
- MIME551 (3) Electrochemical Processing
- MIME555 (3) Thermal Remediation of Wastes
- MIME556 (3) Sustainable Materials Processing
- MIME560 (3) Joining Processes
- MIME561 (3) Advanced Materials Design
- MIME563 (3) Hot Deformation of Metals
- MIME564 (3) X-ray Diffraction Analysis of Materials
- MIME565 (3) Aerospace Metallic-Materials and Manufacturing Processes
- MIME566 (3) Texture, Structure & Properties of Polycrystalline Materials
- MIME567 (3) Aluminum Casting Alloys
- MIME568 (3) Topics in Advanced Materials
- MIME569 (3) Electron Beam Analysis of Materials

0 - 3 credits from the following:
- BMDE504 (3) Biomaterials and Bioperformance
- CHEM455 (3) Introductory Polymer Chemistry
- CHEM585 (3) Colloid Chemistry
- PHYS558 (3) Solid State Physics

General Complementaries: 6 credits
- Two courses (6 credits), selected from an approved list:
  - one course on the impact of technology on society and one in the humanities and social sciences,
  - administrative studies and law. See section 8.3.4 “Complementary Studies” for further information.

TOTAL: 117 credits

CURRICULUM FOR THE B.ENG. DEGREE IN MINING ENGINEERING – CO-OP PROGRAM

REQUIRED COURSES

Non-Departmental Courses
- CIVE205 Statics 3
- CIVE207 Solid Mechanics 4
- COMP208 Computers in Engineering 3
- EPSC221 General Geology 3
- EPSC225 Properties of Minerals 1
- MATH262 Intermediate Calculus 3
- MATH263 Ordinary Differential Equations and Linear Algebra 3
- MATH264 Advanced Calculus 3
- MECH289 Design Graphics 3 26

Departmental Mining Courses
- MIME200 Introduction to the Minerals Industry 3
- MIME202 Engineering Communication Skills 2
- MIME203 Mine Surveying (2 weeks at beginning of summer) 2
- MIME209 Mathematical Applications 3
- MIME221 Engineering Professional Practice 2
- MIME260 Materials Science and Engineering 3
- MIME290 Industrial Work Period 1 2
- MIME291 Industrial Work Period 2 2
- MIME310 Engineering Economy 3
- MIME322 Rock Fragmentation 3
- MIME323 Rock and Soil Mass Characterization 3
- MIME325 Mineral Industry Economics 3
- MIME333 Materials Handling 3
- MIME337 Electrotechnology 2
- MIME340 Applied Fluid Dynamics 3
- MIME341 Introduction to Mineral Processing 3
- MIME392 Industrial Work Period 3 2
- MIME419 Surface Mining 3
- MIME420 Feasibility Study 3
- MIME426 Development and Services 3
- MIME484 Mining Project 3 56

École Polytechnique Mining Courses
- MPMC320 CAO et informatique pour les mines 3
- MPMC321 Mécanique des roches et contrôle des terrains 3
- MPMC326 Recherche opérationnelle I 3
- MPMC328 Environnement et gestion des rejets miniers 3
- MPMC329 Géologie minière 2
- MPMC330 Géotechnique minière 3
- MPMC421 Exploitation en souterrain 3
- MPMC422 Ventilation minière et hygiène du travail 3 23

Technical Courses
- Courses selected from those listed below or any other approved technical course(s) in Engineering, Management or Science.
- Note: not all courses are given annually; verification with course instructor is advised.
- MIME320 (3) Extraction of Energy Resources
- MIME442 (3) Modelling and Control: Mineral Processing
- MIME520 (3) Stability of Rock Slopes
- MIME521 (3) Stability of Underground Openings
- MIME526 (3) Mineral Economics
- MIME528 (3) Mining Automation
- MIME544 (3) Analysis: Mineral Processing Systems 1
- MIME545 (3) Analysis: Mineral Processing Systems 2
- MPMC327 (3) Hydrogéologie appliquée
- MPMC424 (2) Généréx d’exploitation minière

A fee of $300 is assessed by the University for each Industrial Work Period course.
8.4.7 School of Urban Planning

Macdonald-Harrington Building
815 Sherbrooke Street West
Montreal, QC H3A 2K6
Telephone: (514) 398-4075
Fax: (514) 398-8376
E-mail: admissions.planning@mcgill.ca
Website: www.mcgill.ca/urbanplanning

Director — David F. Brown
Emerita Professor
Jeanne M. Wolfe; B.Sc.(Lond.), M.Sc.(W.Ont.), M.A.(McG.)
Professor
Jane M. Glenn; B.A., LL.B.(Qu.), D. en Droit(Stras.)
Associate Professors
David F. Brown; B.A.(Bishop’s), M.U.P.(McG.), Ph.D.(Sheffield)
Assistant Professors
MadHAV G. Badani; B.Tech., M.S.(I.I.T., Madras)
M.E.Des.(Calg.), Ph.D.(UBC) (joint appoint. with McGill School of Environment)
Lisa Bornstein; B.Sc.(U.C.Berk.), M.R.P.(C’nell), Ph.D.(U.C. Berk.)
Murtaza Haider; B.Sc.(Peshawar), M.A.Sc., Ph.D.(Tyr.) (joint appoint. with Civil Engineering)
Associate Member
Gordon O. Ewing; M.A.(Glas.), M.A., Ph.D.(McG.)
Instructor
François Dufaux; B.Arch.(Laval), M.U.P.(McG.)
Adjunct Professors
David Farley; B.Arch.(McG.), M.Arch., M.C.P.(Harv.)
Mario Polèse; B.A.(CUNY), M.A., Ph.D.(Penn.)
Ray Tomalty; B.A., M.P.A., (Queen’s), Ph.D.(Wat.)
Guest Lecturers
CameronCharlebois, LucDanielse, MarcDenhez,
AndrewHoffmann, BrendaLee, Damaris Rose, Alain Trudea,
MartinWexler

Modern urban planning developed into a profession in the early decades of the 20th century, largely as a response to the appalling sanitary, social and economic conditions of rapidly developing industrial cities. Initially, the disciplines of architecture, civil engineering and public health provided the nucleus of concerned professionals; beautification schemes and infrastructure works marked the early stages of public intervention in the 19th century. Architects, engineers and public health specialists were joined by economists, sociologists, lawyers and geographers as the complexities of the city’s problems came to be more fully understood and public pressure mounted for their solution. Contemporary urban and regional planning techniques for survey, analysis, design and implementation developed from an interdisciplinary synthesis of these various fields.

Today, urban planning can be described as the collective management of urban development. It is concerned with the welfare of communities, control of the use of land, design of the built environment, including transportation and communication networks, and protection and enhancement of the natural environment. It is at once a technical and a political process which brings together actors from the public, private and community spheres. Planners participate in that process in a variety of ways, as designers and analysts, advocates and mediators.

McGill University was the first institution in Canada to offer a full-time planning program. An interdisciplinary program was established in 1947, in which students combined a master’s degree in Urban Planning with one in a related field. An autonomous program was established in 1972. It became the School of Urban Planning in 1976.

Students come to the School from diverse backgrounds, the physical sciences, the traditional professions, such as architecture and engineering, and the social sciences. Alumni of the School work as planners and designers at various levels of government, in non-profit organizations and with private consulting firms. Their expertise ranges from historic preservation to transportation planning, from housing development to computer imaging. They devote their efforts in increasing numbers to environmental planning and sustainable development.

The School is a partner in the Montreal Interuniversity Group “Urbanization and Development”, a consortium recognized by CIDA as a Centre of Excellence, which is devoted to the study of urban problems and the formulation of policies in developing regions. Faculty and students collaborate actively with members of other McGill departments, notably Architecture, Geography, Civil Engineering and Law, and with colleagues at other institutions in Canada and abroad.

The objective of the School is to produce qualified professional urban planners for the public, private and not-for-profit sectors. Training is provided at the postgraduate level; the degree offered is the Master of Urban Planning (M.U.P.). Upon completion of the two-year program of studies, graduates are expected to have acquired basic planning skills, a broad understanding of urban issues, and specialized knowledge in a field of their own choice. The program of study offered by the School is fully recognized by the Ordre des Urbanistes du Québec (O.U.Q.) and the Canadian Institute of Planners (C.I.P.). Graduates can become full members of these professional organizations after meeting the O.U.Q.’s internship and examination requirements.

For details of the M.U.P. admission requirements and curriculum, consult the Graduate and Postdoctoral Studies Calendar, available on the Web at www.mcgill.ca.

The following 500-level courses are taught by the faculty of the School:

ARCH550 Urban Planning 1
ARCH551 Urban Planning 2
URBP 501 Principles and Practice 1
URBP 505 Geographic Information Systems
URBP 506 Environmental Policy and Planning
URBP 507 Planning and Infrastructure
URBP 519 Sustainable Development Plans

8.5 Minor Programs and Choice of Electives or Complementary Courses

Minors are coherent sequences of courses which may be taken in addition to the courses required for the B.Eng. degree. Minor programs normally consist of 18-24 credits, allowing 9-12 credits of overlap with the degree program. The real credit cost to the student is typically 9 to 15 credits, representing one term beyond the B.Eng. degree program. All courses in a Minor program must be passed with a grade of C or better.

Students of the Faculty have a considerable variety of complementary courses, which fall into the categories of technical and complementary studies. Students should refer to their respective departments for information concerning complementary course selections. Departments also publish, in this Calendar and in separate documents, information regarding the choice of courses. Students should also consult their course advisers.

General information concerning Minors that are designed for students registered in the Faculty of Engineering is listed below. In addition, students are also permitted to register for Minor Concentrations offered through the various departments in the Faculty of Arts. Students are advised to seek approval from the specific department in the Faculty of Arts as well as the Faculty of Engineering Student Affairs Office, Room 378, Macdonald Engineering Building, prior to embarking on these Minors.

8.5.1 Arts Minor

Engineering students may obtain a Minor in Arts as part of their B.Eng. degree by satisfying the 24-credit requirement described below. In general, complementary studies courses given in the Faculty of Arts and listed under: (i) — “3 credits of studies of the
Impact of Technology on Society and (ii) – “the remaining credits to be elective social science and humanities courses” (see section 8.3.4 “Complementary Studies”) may be used to satisfy some of these requirements. In no case will more than 6 credits taken from these complementary studies requirements be credited towards the Minor in Arts.

Requirements
1. The program must consist of 24 credits as follows:
   a) at least two areas of concentration from within the Faculty of Arts must be chosen, with the minimum number of credits in any one area being 6;
   b) at least 12 credits must be at the 300 or above level.
2. All courses in the Minor program must be passed with a grade of C or better.
3. The selection of courses for the Minor is to be done in consultation with the Minor adviser, Ms. Judy Pharo, Faculty of Engineering Student Affairs Office.

For further information, contact Professor B. Haskel, Political Science, or Ms. J. Pharo, Student Affairs Office, Faculty of Engineering.

8.5.2 Biotechnology Minor
The Faculties of Engineering and of Science offer a Minor in Biotechnology for students interested in taking additional courses in this area. For Engineering students, the Minor has been designed specifically for students within the Chemical Engineering Department; however, other Engineering students are invited to contact the Minor program supervisor, Professor Bennett, or Ms. Judy Pharo, Faculty of Engineering Student Affairs Office, for further information.

Students should identify an interest in the Minor to their academic adviser and the supervisor of the program during the U1 year, and at the time of registration for the U2 year. With the agreement of the academic adviser, students should submit their course list to the program supervisor who will certify that the proposed program conforms to the requirements for the Minor.

The Biotechnology Minor Program is administered for the Faculties of Engineering and of Science by Prof. H. Bennett, Sheldon Biotechnology Centre (Lyman Duff Building), phone (514) 398-3998. A full description of the Minor program appears under the Faculty of Science, see section 12.12.5 “Biotechnology (BIOT)”. A Chemical Engineering student may complete the Biotechnology Minor by taking BIOL200, BIOL201, BIOL202, MIMM211, BIOT505, plus one course from the list of additional courses not including MIMM310. The Department of Chemical Engineering permits students in the Minor program to complete BIOT505 as one of their technical complementary requirements. The total course credit required for the Chemical Engineering student is 15 credits beyond the 111-credit B.Eng. program.

8.5.3 Chemistry/Chemical Engineering Minor
The Departments of Chemistry and Chemical Engineering offer a Minor Program in Chemistry, of particular interest to Chemical Engineering students, and a Minor in Chemical Engineering, of interest to Chemistry students (described under the Faculty of Science). The Minor in Chemistry consists of 25 credits as follows:
1. Required courses, 10 credits: CHEM212, CHEM233 and CHEM234 (or CEGEP equivalent).
2. At least 15 credits from the following list, two of which must be laboratory courses (* indicates lab). Note that CHEM212 is a prerequisite for most of the courses listed below. If students take CHEM222* instead of CHEM234, they will receive credit for one of the two laboratories that are required but they must have a total of 25 Chemistry credits for the Minor.

Inorganic Chemistry
CHEM281 Inorganic Chemistry 1
CHEM371 Inorganic Chemistry Laboratory*
CHEM381 Inorganic Chemistry 2
CHEM591 Bioinorganic Chemistry

Analytical Chemistry
CHEM257D1 Introductory Analytical Chemistry*
CHEM257D2 Introductory Analytical Chemistry*
or CHEM277D1 Analytical Chemistry*
CHEM277D2 Analytical Chemistry*

CHEM307 Analytical Chemistry of Pollutants
CHEM367 Instrumental Analysis 1
CHEM377 Instrumental Analysis 2

Organic Chemistry
CHEM302 Introductory Organic Chemistry 3
CHEM352 Structural Organic Chemistry
CHEM362 Advanced Organic Chemistry Laboratory*
CHEM382 Organic Chemistry: Natural Products
CHEM402 Advanced Bio-organic Chemistry

Physical Chemistry
CHEM345 Molecular Properties and Structure 1
CHEM355 Molecular Properties and Structure 2
CHEM363 Physical Chemistry Laboratory 1*
CHEM393 Physical Chemistry Laboratory 2*
CHEM455 Introductory Polymer Chemistry

Please consult the program coordinators for more information: Professor D. Cooper (Chemical Engineering) and Dr. G. Wilczek (Chemistry). A passing grade for courses within the Minor is a C.

8.5.4 Computer Science Courses and Minor Program
The School of Computer Science offers an extensive range of courses for Engineering students interested in computers. The course explicitly for Engineering students (COMP208) and other courses in the core of the various Engineering programs are listed below. Descriptions of these and other Computer Science courses can be found on Class Schedule or in the Courses section.

COMP202 Introduction to Computing 1
COMP208 Computers in Engineering
COMP250 Introduction to Computer Science
COMP302 Programming Languages and Paradigms

Engineering students may obtain a Minor in Computer Science as part of their B.Eng. degree by satisfying the 24-credit requirement described below. In general, some complementary courses within Engineering departmental programs may be used to satisfy some of these requirements, but the Minor in Computer Science will require at least 12 extra credits from Computer Science (COMP) courses beyond those needed for the B.Eng. degree. Students should consult their departments about the use of complementary courses that can be double counted.

Students should see the Undergraduate Secretary in the Lorne Trottier Building, Room 2060, to obtain the appropriate forms and to make an appointment to see the Minor adviser for approval of their course selection. Forms must be approved before the end of the Add/Drop period of the student’s final term.

For further information, please check the School of Computer Science Website, www.cs.mcgill.ca/acadpages/undergrad.

Minor in Computer Science for Engineering Students
The program must consist of 24 credits, from courses passed with a grade of C or better, as follows:

Required Course (3 credits)
COMP302 (3) Programming Languages and Paradigms

Complementary Courses (21 credits)
3 credits – one of the following courses:
COMP203 (3) Introduction to Computing 2
COMP250 (3) Introduction to Computer Science

3 credits – one of the following courses:
COMP206 (3) Introduction to Software Systems
ECSE221 (3) Introduction to Computer Engineering

3 credits – one of the following courses:
COMP273 (3) Introduction to Computer Systems
ECSE222 (3) Introduction to Computer Engineering 2
8.5.5 Construction Engineering and Management Minor

Students in the Faculty of Engineering may obtain a Minor in Construction Engineering and Management by completing 24 to 25 credits chosen from the required and complementary courses listed below. By a careful selection of complementary courses, a Civil Engineering student may obtain this Minor by completing as few as 9 additional credits. Students in other departments would typically require 12 to 15 additional credits to complete the Minor. For further information, contact Professor L. Chouinard at (514) 398-6446, Room 488, Macdonald Engineering Building.

Prerequisites:
- CIVE208 Civil Engineering Systems Analysis
- CIVE302 Probabilistic Systems or equivalent
- COMP208 Computers in Engineering or equivalent
- MIME310 Engineering Economy

Requirements:
The 24 to 25 credits listed below must be completed with a grade of C or higher in order to fulfill the requirements of the Minor.

1. Management and Law: 15 credits, as follows:
   - FACC220 (3) Law for Architects and Engineers
   - INDR294 (3) Introduction to Labour-Management Relations
   - MGCR211 (3) Introduction to Financial Accounting
   - MGCR341 (3) Finance I
   - and one of:
   - CIVE324 (3) Construction Project Management
   - MECH472 (3) Case Studies in Project Mgmt

2. Either 3 or 4 credits, as follows:
   a) 4 credits - Any two of the following relating to Building Structures:
      - ARCH447 (2) Electrical Services
      - ARCH451 (2) Building Regulations and Safety
      - ARCH554 (2) Mechanical Services
      - CIVE492 (2) Structures
   b) 3 credits - One of the following relating to Heavy Construction:
      - MIME322 (3) Rock Fragmentation
      - MIME333 (3) Materials Handling

3. Other Construction-Related Complementary: 6 credits
   Any two of the following:
   - BREE411 (3) Off-Road Power Machinery
   - BUSA462 (3) Management of New Enterprises
   - CIVE446 (3) Construction Engineering
   - CIVE527 (3) Renovation and Preservation: Infrastructure
   - CIVE586 (3) Earthwork Engineering
   - ECSE461 (3) Electric Machinery
   - FINE445 (3) Real Estate Finance
   - MIME520 (3) Stability of Rock Slopes
   - MIME521 (3 Stability of Underground Openings
   - MIME526 (3) Stability of Rock Slopes
   - MPMC321 (3) Mécanique des roches et contrôle des terrains

Total requirement: 24 or 25 credits

8.5.6 Economics Minor

The Minor consists of 18 credits in courses given in the Economics Department. It consists of required courses and complements. In addition, it is presumed that all Engineering students will have a sufficient background in mathematics. Engineering Economy, MIME310, does not form part of this Minor. For more information see the Department of Economics, Room 443, Leacock Building.

Required Courses (9 credits)
   - ECON209** Macroeconomic Analysis and Applications
   - ECON220D1* Microeconomic Theory
   - ECON230D2* Microeconomic Theory

Complementary Courses (9 credits) from:
   - ECON225 Economics of the Environment
   - ECON250D1 Microeconomics of Public Policy
   - ECON250D2 Macroeconomics of Public Policy
   - ECON305 Industrial Organization
   - ECON306D1 Labour Economics and Institutions
   - ECON306D2 Labour Economics and Institutions
   - ECON308 Public Policies Toward Business
   - ECON311 United States Economic Development
   - ECON313 Economic Development 1
   - ECON314 Economic Development 2
   - ECON316 The Underground Economy
   - ECON321 The Quebec Economy
   - ECON326 Ecological Economics
   - ECON329 Economics of Confederation
   - ECON330D1 Macroeconomic Theory
   - ECON330D2 Macroeconomic Theory
   - ECON331 Economic Development: Russia and USSR
   - ECON332 Comparative Economic Systems
   - ECON333 Comparative Economic Systems
   - ECON335 The Japanese Economy
   - ECON337 Introductory Econometrics 1
   - ECON344 The International Economy, 1830 - 1914
   - ECON345 The International Economy Since 1914
   - ECON347 Economics of Global Warming
   - ECON404 Transportation
   - ECON405 Natural Resource Economics
   - ECON406 Topics in Economic Policy
   - ECON408D1 Public Sector Economics
   - ECON408D2 Public Sector Economics
   - ECON411 Economic Development: A World Area
   - ECON416 Topics in Economic Development 2
   - ECON420 Topics in Economic Theory
   - ECON423D1 International Trade and Finance
   - ECON423D2 International Trade and Finance
   - ECON426 Labour Economics
   - ECON434 Current Economic Problems
   - ECON440 Health Economics
   - ECON447 Economics of Information and Uncertainty
   - ECON457D1 Econometrics - Honours
   - ECON457D2 Econometrics - Honours
   - ECON525 Project Analysis
   - ECON534 Pensions Crisis
   - ECON546 Game Theory

Mining Engineering students will be permitted to include Mineral Economics (MIME526) among these 18 credits.

* Students may, with consent of instructor, take ECON250D1/ ECON250D2 Introduction to Economic Theory: Honours, in place of ECON230D1/ECON230D2.
8.5.7 Environmental Engineering Minor

The Environmental Engineering Minor is offered for students of Engineering and the Department of Bioresource Engineering (formerly Agricultural and Biosystems Engineering) wishing to pursue studies in this area.

The Minor program consists of 21 credits in courses. Up to a maximum of 12 credits of coursework in the student’s B.Eng. program may double-count with the Minor.

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

The Environmental Engineering Minor Program is administered by the Department of Civil Engineering and Applied Mechanics. Further information may be obtained from Professor S. Ghoshal, Room 475C, Macdonald Engineering Building.

Note: Not all courses listed are offered every year. Students should consult with the department concerned about the courses that are offered in a given year.

Minor Requirements (21 credits)

Introductory course (3 credits minimum) – one of:
- CIVE225 (4) Environmental Engineering

plus a minimum of 18 credits, either:
- 15 credits* (minimum) Engineering courses and 3 credits (minimum) Non-Engineering courses, from the course lists below:

* A minimum of 6 credits must be from outside the student’s principal departmental program. A maximum of 6 credits of research project courses may be counted towards this category provided the project has sufficient environmental engineering content (project proposal requires approval of project supervisor and Coordinator of the Minor).

OR

15 credits specified for the section 15.1.2 “Barbados Field Study Semester”, provided the project for CIVE/AGRI/URBP 519 Sustainable Development Plans has sufficient environmental engineering content (project proposal requires approval of the Coordinator of the Minor) and

3 credits chosen from the Engineering Course list below, excluding CHEE496.

Engineering Course List

(Environmental Engineering Minor)

Agricultural Engineering (Macdonald Campus)
- BREE217 (3) Hydrology and Water Resources (not open to students who have passed CIVE323)
- BREE322 (3) Organic Waste Management
- BREE330 (3) GIS for Biosystems Engineering
- BREE416 (3) Engineering for Land Development
- BREE518 (3) Bio-Treatment of Wastes

Chemical Engineering
- CHEE351 (3) Separation Processes
- CHEE370 (3) Elements of Biotechnology
- CHEE430 (3) Technology Impact Assessment (not open to students who have passed WILD437)
- CHEE452 (3) Particulate Systems (offered in alternate years)
- CHEE471 (3) Industrial Water Pollution Control (not open to students who have passed CIVE430)
- CHEE472 (3) Industrial Air Pollution Control
- CHEE496 (3) Environmental Research Project

Civil Engineering and Applied Mechanics
- CIVE225 (4) Environmental Engineering
- CIVE323 (3) Hydrology and Water Resources (not open to students who have passed BREE217)
- CIVE421 (3) Municipal Systems
- CIVE430 (3) Water Treatment and Pollution Control (not open to students who have passed CHEE471)
- CIVE451 (3) Geoenvironmental Engineering
- CIVE526 (3) Solid Waste Management
- CIVE550 (3) Water Resources Management
- CIVE553 (3) Stream Pollution and Control
- CIVE555 (3) Environmental Data Analysis
- CIVE572 (3) Advanced Hydraulics
- CIVE574 (3) Fluid Mechanics of Water Pollution
- CIVE577 (3) River Engineering
- CIVE585 (3) Groundwater Hydrology

Mechanical Engineering
- MECH343 (3) Energy Conversion
- MECH434 (3) Turbomachinery
- MECH447 (3) Combustion
- MECH525 (3) Intro. to Nuclear Engineering
- MECH526 (3) Manufacturing and the Environment
- MECH534 (3) Air Pollution Engineering

Miner, Metals and Materials Engineering
- MIME412 (3) Corrosion and Degradation
- MIME451 (3) Environmental Controls: Met'l Plants
- MIME555 (3) Thermal Remediation of Wastes
- MPMC327 (3) Hydrogéologie appliquée
- MPMC328 (3) Environnement et gestion des rejets miniers
- MPMC422 (3) Ventilation minière et hygiène du travail

Urban Planning
- URPB506 (3) Environmental Policy and Planning

Non-Engineering Course List

(Environmental Engineering Minor)

Agricultural Sciences (Macdonald Campus)
- AEIB200 (3) Biology of Organisms
- AEIB201 (3) Biology of Organisms 2
- AEIB205 (3) Principles of Ecology
- AEPH510 (3) Agricultural Micrometeorology
- ENTO380 (3) Food Systems and the Environment
- MICR230 (3) Introductory Microbiology (not open to students who have passed CHEE370)
- MICR331 (3) Microbial Ecology (not open to students who have passed CHEE370)
- MICR341 (3) Mechanisms of Pathogenicity

Anthropology
- ANTH206 (3) Environment and Culture

Atmospheric and Oceanic Sciences
- ATOC210 (3) Introduction to Atmospheric Science (not open to students who have passed GEOG321)
- ATOC220 (3) Introduction to Oceanic Sciences

Biology
- BIOL205 (3) Biology of Organisms
- BIOL208 (3) Introduction to Ecology
- BIOL432 (3) Limnology

SOIL31 (3) Principles of Soil Science (not part of the Minor for Agricultural Engineering Students)

SOIL331 (3) Soil Physics
- WILD333 (3) Physical and Biological Aspects of Pollution
- WILD375 (3) Issues: Environmental Sciences
- WILD415 (3) Conservation Law
- WILD437 (3) Assessing Environmental Impact (not open to students who have passed CHEE430)
- WOOD420 (3) Environmental Issues: Forestry
- ZOOL315 (3) Science of Inland Waters

Further information may be obtained from Professor S. Ghoshal, Room 475C, Macdonald Engineering Building.
BIOL470 (3) Lake Management
Chemistry
CHEM307 (3) Analytical Chemistry of Pollutants
Earth and Planetary Sciences
EPSC243 (3) Environmental Geology (not open to students who have passed or who will take EPSC221)
EPSC549 (3) Groundwater Hydrology
Economics
ECO225 (3) Economics of the Environment
ECO326 (3) Ecological Economics
ECO347 (3) Economics of Climate Change
Geography
GEOG200 (3) Geographical Perspectives: World Environmental Problems
GEOG201 (3) Introductory Geo-Information Science
GEOG203 (3) Environmental Systems
GEOG205 (3) Global Change: Past, Present and Future
GEOG302 (3) Environmental Management 1
GEOG308 (3) Principles of Remote Sensing
GEOG321 (3) Climatic Environments (not open to students who have passed ATOC210)
GEOG404 (3) Environmental Management 2
Law
CMPL580 (3) Environment and the Law
Microbiology and Immunology
MIME211 (3) Introductory Microbiology
Religious Studies (Macdonald Campus)
RELG270 (3) Religious Ethics and the Environment
Sociology
SOCI328 (3) Environmental Sociology

8.5.8 Minor in Environment

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

The Minor in Environment is offered and administered by the McGill School of Environment (MSE). Inquiries should be directed to Mr. Peter Barry, MSE Program Coordinator, e-mail info.mse@mcgill.ca or telephone (514) 398-4306.

Since the program comprises a total of 18 credits for the Minor, additional credits beyond those needed for the B.Eng. degree are required. Students wishing to receive the Minor should prepare a program and have it approved by both their regular Engineering adviser and the MSE adviser. For program details, see "Minor in Environment", in section 14.4.

8.5.9 Management Courses and Minor Program

Many engineers begin to assume management functions within a few years of graduation. They can, at this stage, take up the study of economics, behavioural science and other management subjects. Students wishing to include such studies in their undergraduate program can take suitable courses from Engineering and Management as listed below.

Engineering Economy MIME310 introduces the concept of costs into evaluations of engineering projects and architectural proposals. Prerequisite to entry to this Minor is a grade C or better in MIME310.

Several additional courses are available, subject to timetable requirements, from the core program of the Faculty of Management. Other courses from the Management core program have considerable overlap with Engineering courses and thus are not available to Engineering students.

Note: Course MGCR211, a course in statistics, and a course in micro-economics are prerequisite for MGCR341. If included in the

Minor in Management, MGCR423 should be taken at the end of the program.

Engineering students may obtain a Minor in Management by completing 15 credits of courses from the following list of Faculty of Management courses with a grade of C or better. Successful completion of this Minor is noted on a student's transcript.

Required Courses (6 credits)
MGCR211 Introduction to Financial Accounting
MGCR320 Managing Human Resources

Complementary Courses (9 credits)
3 credits, one of List A:
MGCR213 Introduction to Management Accounting
MGCR341 Finance 1
MGCR373 Operations Research 1
MGCR382 International Business

3 credits, one of List B:
BUS462 Management of New Enterprises
or BUSA465 Technological Entrepreneurship
MGCR222 Introduction to Organizational Behaviour
MGCR352 Marketing Management 1
or MRKT360 Marketing of Technology
MGCR360 Social Context of Business
MGCR423 Organizational Policy

3 credits, any available 300- or 400-level Management course (for which the prerequisites, if any, have been met).

An Engineering course deemed equivalent by the Faculty of Management may be substituted for course MGCR373. There are three courses in Engineering that qualify: CIVE208, MECH474 and MPMC326. It should be noted that MGCR373 does not count as a technical complementary course.

A student embarking on the Minor must be prepared to take credits additional to the normal Engineering program. The student may choose the non-technical complementary course(s) required in his/her program from list B above, but under no circumstances will more than 6 credits of non-technical complementary courses count towards both the Engineering program and the Minor. Students considering this Minor should consult their adviser or the Faculty of Engineering Student Affairs Office.

8.5.10 Materials Engineering Minor

Engineering students may obtain a Minor in Materials Engineering 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. It should be noted that some departments (e.g., Mechanical Engineering) will allow their students to take courses from this list providing they complete the Minor prior to graduation. For further information, please contact the coordinator, Prof. J. Szpunar, Room 2M020, Wong Building.

Required Courses (15 credits)
MIME260 Materials Science and Engineering
or CHEE380 Materials Science
MIME367 Electronic Properties of Materials
MIME465 Ceramic Engineering
CHEE481 Polymer Engineering
CHEE484 Materials Engineering

Complementary Courses (9 credits)
Three courses to be chosen from the following list:
CHEE381 Polymer Technology
CHEE483 Industrial Rheology
CHEE487 Chemical Processing Electronics Industry
CHEE530 Structure and Properties of Paper
CHEE581 Polymer Composites Engineering
CHEM455 Introductory Polymer Chemistry
ECSE545 Microelectronics Technology
MECH530 Mechanics of Composite Materials
MIME360 Phase Transformations: Solids
MIME361 Liquid State Processing of Materials
Students considering the Minor should consult Ms. Judy Pharo, Faculty of Engineering Student Affairs Office, e-mail judy.pharo@mcgill.ca.

**Complementary Courses (18 credits)**

- BUSA465 (3) Technological Entrepreneurship
- FACC500 (3) Technology Business Plan Design
- FACC501 (3) Technology Business Plan Project
- MGCR320 (3) Managing Human Resources
- MGCR423 (3) Organizational Policy
- MRKT360 (3) Marketing of Technology
- ORGB321 (3) Leadership

### 8.5.11 Mathematics Minor

The Minor in Mathematics for students in the Faculty of Engineering requires satisfactory passes in 24 credits of approved courses in Mathematics not including the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>MATH247</td>
<td>(or MATH223)</td>
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<tr>
<td>MATH260</td>
<td>(or MATH262 or MATH222)</td>
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<tr>
<td>MATH261</td>
<td>(or MATH263 or MATH315 or MATH325)</td>
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<tr>
<td>MATH265</td>
<td>(or MATH264 or MATH248 or MATH314)</td>
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<tr>
<td>MATH266</td>
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<tr>
<td>MATH270</td>
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<td>MATH319</td>
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At least 18 credits must be chosen from the Mathematics and Statistics courses approved for the Mathematics Majors or Honours program, or from MATH249, MATH363, MATH381, MATH386. The remaining credits may be chosen from mathematically allied courses.

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

### 8.5.12 Physics Minor

Students in Honours Electrical Engineering may obtain a Minor in Physics as part of their B.Eng. degree by satisfying the 18-credit requirement listed below:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>PHYS253</td>
<td>Thermal Physics</td>
</tr>
<tr>
<td>PHYS357</td>
<td>Quantum Physics</td>
</tr>
<tr>
<td>PHYS457</td>
<td>Quantum Physics</td>
</tr>
<tr>
<td>PHYS332</td>
<td>Physics of Fluids</td>
</tr>
<tr>
<td>PHYS362</td>
<td>Statistical Mechanics</td>
</tr>
<tr>
<td>PHYS451</td>
<td>Classical Mechanics</td>
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<tr>
<td>PHYS514</td>
<td>General Relativity</td>
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<tr>
<td>PHYS551</td>
<td>Quantum Theory</td>
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<tr>
<td>PHYS557</td>
<td>Nuclear Physics</td>
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<tr>
<td>PHYS558</td>
<td>Solid State Physics</td>
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<td>PHYS559</td>
<td>Advanced Statistical Mechanics</td>
</tr>
<tr>
<td>PHYS562</td>
<td>Electromagnetic Theory</td>
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<tr>
<td>PHYS567</td>
<td>Particle Physics</td>
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</tbody>
</table>

and at least 9 credits chosen from the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS322</td>
<td>Physics of Fluids</td>
</tr>
<tr>
<td>PHYS362</td>
<td>Statistical Mechanics</td>
</tr>
<tr>
<td>PHYS451</td>
<td>Classical Mechanics</td>
</tr>
<tr>
<td>PHYS514</td>
<td>General Relativity</td>
</tr>
<tr>
<td>PHYS551</td>
<td>Quantum Theory</td>
</tr>
<tr>
<td>PHYS557</td>
<td>Nuclear Physics</td>
</tr>
<tr>
<td>PHYS558</td>
<td>Solid State Physics</td>
</tr>
<tr>
<td>PHYS559</td>
<td>Advanced Statistical Mechanics</td>
</tr>
<tr>
<td>PHYS562</td>
<td>Electromagnetic Theory</td>
</tr>
<tr>
<td>PHYS567</td>
<td>Particle Physics</td>
</tr>
</tbody>
</table>

Students who take PHYS357 and PHYS457 can omit PHYS271 from their normal Electrical Engineering program. Candidates must go to the Department of Physics at registration time in their U3 year to fill out a Minor Program Form.

### 8.5.13 Technological Entrepreneurship Minor

Engineering students may obtain a Minor in Technological Entrepreneurship by completing 6 courses (18 credits) as listed below.

- COMP203 (3) Introduction to Computing 2
- COMP250 (3) Introduction to Computer Science

At least one course (3 credits) must be selected from the following list of engineering courses:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIVE460</td>
<td>(3) Matrix Structural Analysis</td>
</tr>
<tr>
<td>CIVE550</td>
<td>(3) Water Resources Management</td>
</tr>
<tr>
<td>CIVE572</td>
<td>(3) Computational Hydraulics</td>
</tr>
<tr>
<td>ECSE322</td>
<td>(3) Computer Engineering</td>
</tr>
<tr>
<td>ECSE424</td>
<td>(3) Human-Computer Interaction</td>
</tr>
<tr>
<td>ECSE427</td>
<td>(3) Operating Systems</td>
</tr>
<tr>
<td>ECSE526</td>
<td>(3) Artificial Intelligence</td>
</tr>
<tr>
<td>ECSE531</td>
<td>(3) Real Time Systems</td>
</tr>
<tr>
<td>ECSE532</td>
<td>(3) Computer Graphics</td>
</tr>
<tr>
<td>MECH474</td>
<td>(3) Selected Topics in Operations Research</td>
</tr>
<tr>
<td>MECH524</td>
<td>(3) Computer Integrated Manufacturing</td>
</tr>
<tr>
<td>MECH539</td>
<td>(3) Computational Aerodynamics</td>
</tr>
<tr>
<td>MECH545</td>
<td>(3) Advanced Stress Analysis</td>
</tr>
<tr>
<td>MECH576</td>
<td>(3) Computer Graphics and Geometrical Modelling</td>
</tr>
</tbody>
</table>

No more than two courses (6 credits) can be selected from the following list of courses offered by the School of Computer Science:

- COMP302 (3) Programming Languages and Paradigms
- COMP335 (3) Software Engineering Methods
- COMP420 (3) Files and Databases
- COMP421 (3) Database Systems
- COMP424 (3) Topics: Artificial Intelligence 1
- COMP426 (3) Automated Reasoning
- COMP431 (3) Algorithms for Engineers
- COMP433 (3) Personal Software Engineering
- COMP538 (3) Person-Machine Communication