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1 The Faculty

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

1.2 Administrative Officers

John E. Gruzleskl; 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)**

Juan H. Vera; B.Mat.(Chile), Ing.Quim.(U.T.E.), M.S. (Berkeley), Dr.Ing.(Santa Maria), Ing. **Associate Dean (Research)**

David Covo; B.Sc.(Arch.), B.Arch.(McG.), M.R.A.I.C., O.A.Q. **Director, School of Architecture**

David F. Brown; B.A.(Bishop's), M.U.P.(McG.), Ph.D. (Sheffield) **Director, School of Urban Planning**

Richard J. Munz; B.A.Sc., M.A.Sc.(Wat.), Ph.D.(McG.), Eng. **Chair, Department of Chemical Engineering**

Denis Mitchell; B.A.Sc., M.A.Sc., Ph.D.(Tor.), F.A.C.I., Eng. **Chair, Department of Civil Engineering and Applied Mechanics**

David A. Lowther; B.Sc.(London), Ph.D.(C.N.A.A.), P.Eng. **Chair, Department of Electrical and Computer Engineering**

Arun K. Misra; B.Tech.(I.I.T., Kharagpur), Ph.D.(U.B.C.), P. Eng. **Chair, Department of Mechanical Engineering**

Robin A.L. Drew; B.Tech.(Bradford), Ph.D.(Newcastle) **Chair, Department of Mining, Metals and Materials Engineering**

Jonathan Rousham **Building Administrator**

Steve Yue; B.Sc., Ph.D.(Leeds) **Secretary of Faculty**

Ida Godefroy **Assistant to the Dean**

Judy Pharo **Faculty Student Advisor**

Nancy Czemmel **Records Student Affairs Officer**

Debbie Morzajew **Manager, EMF**

Suse Vodopivec **Banner SIS Trainer**

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 creation of the Department. Continued growth led to the formation of the Faculty of Applied Science in 1878. By 1910 there were ten degree programs offered, including Architecture and Railroad Engineering. Subsequent changes in the overall pattern of the University led to the creation of the Faculty of Engineering in 1931 with a departmental structure very similar in name to that which exists at present.

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 2300 undergraduate students and 700 graduate students in a wide variety of academic programs.

Undergraduate programs leading to professional bachelor degrees are offered in all Engineering Departments. These programs 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 plan to work in related fields not requiring professional qualification. The curricula are structured to provide suitable preparation for those who plan to continue their education in post-graduate studies either at McGill or elsewhere. The professional degrees in Architecture and Urban Planning are offered at the Master's level and are described in the *Graduate and Postdoctoral Studies Calendar*.

The academic programs are divided into required and complementary sections. The required courses emphasize those basic principles which permit graduates to keep abreast of progress in technology throughout their careers. Exposure to current technology is provided by the wide variety of complementary courses which allow students to pursue in depth a particular interest. For program details refer to section 4 "Academic Programs".

An internship program involving a paid 8- to 16-month industrial work experience is available to Engineering and Science students. Generally students will enter the internship program before starting their final year of undergraduate studies. Details can be found in section 2.9 "IYES: Internship Year for Engineering and Science". In addition, CO-OP programs are offered in Mining Engineering and in Metals and Materials Engineering.

Post-graduate programs leading to Master's and Doctoral degrees are offered in all sectors of the Faculty. Numerous areas of specialization are available in each of the departments and schools. All post-graduate programs including the professional degree programs in Architecture and in Urban Planning are described in the *Graduate and Postdoctoral Studies Calendar*.

1.5 Special Facilities and Related Programs

1.5.1 Engineering Microcomputing Facility

In addition to the services provided by the Computing Center, the Faculty, in conjunction with its departments and schools, maintains specialized computing and information resources in support of teaching and research. These vary from desktop PCs distributed throughout the Engineering complex to very high performance scientific workstations found in the research laboratories. Each unit organizes and maintains facilities that are designed around specific roles, e.g. CAD/CAM, microelectronic design, software engineering, circuit simulation, process control, polymers, structural mechanics, metal processing, etc., in addition to systems dedicated to administrative support.

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 cooperation with the McGill Computing Centre which provides remote access to the Faculty network.

1.5.2 Agricultural and Biosystems Engineering

The Faculty of Engineering cooperates with the Faculty of Agricultural and Environmental Sciences in providing courses of instruction for a curriculum in agricultural and biosystems engineering to meet requirements for a professional degree awarded in the Faculty of Agricultural and Environmental Sciences. The second term of the penultimate year of the program is given by the Faculty of Engineering on the Downtown Campus. Details of the curriculum can be found under the Department of Agricultural and Biosystems Engineering, see page 306.

Some of the courses offered by the Department of Agricultural and Biosystems Engineering (Subject Code ABEN) may be of interest to students in the Faculty of Engineering.

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. A partial list follows (see the *Graduate and Postdoctoral Studies Calendar*, accessible at www.mcgill.ca, for others):

BMDE 501 Selected Topics in Biomedical Engineering
BMED 503 Biomedical Instrumentation
BMED 519 Biomedical Signals and Systems.

1.6 Library Facilities

The University has numerous libraries. Specifically serving Engineering, 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 Hitschfeld Geographic Information Center, Edward Rosenthall Mathematics and Statistics Library, and the Howard Ross Management Library. Further information is available on the Web at www.library.mcgill.ca.

2 General Information

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 limited.

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 "Admission Requirements" on page 13.

2.2 Exchange Programs

The Faculty of Engineering participates in a number of exchange programs that provide undergraduates with an opportunity to study at École Polytechnique and other Quebec universities, and at selected colleges and universities in the United States, Mexico and Europe. Applicants must have completed at least one year of study and have maintained an average of 3.00 or better. Further information may be obtained from the Faculty of Engineering Student Affairs Office, or the Exchange Officer, Admissions, Recuitment and Registrar's Office.

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 "Transfer Credits" on page 34.

2.4 Advanced Credit Examinations

Prior to their first registration, the Faculty of Engineering offers the opportunity for students entering the Faculty from a Quebec CEGEP program to receive advanced credit in MATH 260 Intermediate Calculus upon successful completion of the Advanced Credit Examination. The examination covers material that has a similarity to the syllabus of the CEGEP Calculus III course. For specific date(s) and time(s) of the examination, please refer to the Faculty of Engineering Website at www.mcgill.ca/engineering.

In all engineering programs, students who are successful in the MATH 260 Intermediate Calculus examination will automatically have the number of credits required for the completion of their program reduced by three.

2.5 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 "Registration" on page 27. **It is mandatory for all returning students to see a Departmental Academic Advisor 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 Advisor during the advising period.**

2.5.1 Registration for Continuing Education Courses

Students wishing to take a course(s) via the Centre of Continuing Education for credit must register through the Student Affairs Office. A complete Course Authorization Form will be required. Students must refer to the *Centre of Continuing Education Calendar* and Timetable for course information and deadlines. For further information, contact the Student Affairs Office.

2.5.2 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.

2.6 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:

General Information	(514) 398-7257
Architecture	(514) 398-6702
Chemical Engineering	(514) 398-4494
Civil Engineering	(514) 398-6860
Electrical and Computer Engineering	(514) 398-7344
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

2.7 Student Activities

The campus offers a wide variety of extra-curricular 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.

2.8 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 or from the Admissions, Recuitment and Registrar's Office. Specific information concerning these awards may be obtained from the Faculty Student Advisor, Faculty of Engineering Student Affairs Office.

2.9 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 post-graduate 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 Internet www.mecc.mcgill.ca or by sending an e-mail to info@mecc.mcgill.ca.

2.10 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.

3 Academic Requirements

3.1 Degree Requirements

In order to obtain a Bachelor's degree, students must complete one of the departmental programs described in section 4 "Academic Programs".

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 the 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, the French 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.

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 4 "Academic Programs".

CHEM 110	(4 credits)	General Chemistry 1
CHEM 120	(4 credits)	General Chemistry 2
MATH 140	(3 credits)	Calculus 1
or MATH 139	(4 credits)	Calculus
or MATH 150	(4 credits)	Calculus A
MATH 141	(4 credits)	Calculus 2
or MATH 151	(4 credits)	Calculus B
MATH 133	(3 credits)	Vectors, Matrices and Geometry
PHYS 131	(4 credits)	Mechanics and Waves
PHYS 142	(4 credits)	Electromagnetism and Optics
xxxx xxx	(3 credits)	Humanities/Social Sciences course

Calculus courses MATH 150/MATH 151 are designed for students who have completed a course in high school calculus. Students who complete the Calculus sequence MATH 150/ MATH 151 will receive exemption with credit from MATH 260 (Intermediate Calculus), in the regular Engineering program.

In the event that the student has some prior calculus, but is not sufficiently confident to proceed with MATH 150/MATH 151, the appropriate sequence is MATH 140/MATH 141.

If a student has no previous calculus exposure, MATH 150/ MATH 151 may be replaced with MATH 139/MATH 141.

Students who are uncertain as to which calculus course sequence is appropriate for them should contact Ms. Pharo, Faculty Student Advisor in the Faculty of Engineering Student Affairs Office (514) 398-7256.

Students who successfully complete one, or more, McGill Placement Test will obtain credit for the equivalent(s) , i.e., CHEM 110, CHEM 120, MATH 140, MATH 141, MATH 133, PHYS 131, PHYS 142. Details are provided on the Faculty Website at www.mcgill.ca/engineering.

Students entering with advanced standing credits (Advanced Placements, Advanced Levels, International Baccalaureate examinations, McGill Placement Tests) are required to meet with the Faculty Student Advisor, Faculty of Engineering Student Affairs Office, to finalize their program of studies. (This must be done prior to meeting with the Departmental Advisor.) An information session will be held prior to the advising sessions to process these advanced credits. Information is available on the Faculty Website at www.mcgill.ca/engineering.

3.1.3 Architecture – Basic Science Requirements for Students Entering from Outside Quebec

Generally, students admitted to Architecture from outside Quebec are required to complete the following courses:

CHEM 110	(4 credits)	General Chemistry 1
CHEM 120	(4 credits)	General Chemistry 2
MATH 139	(4 credits)	Calculus
or MATH 140	(3 credits)	Calculus 1
MATH 141	(4 credits)	Calculus 2
MATH 133	(3 credits)	Vectors, Matrices and Geometry
PHYS 131	(4 credits)	Mechanics and Waves
PHYS 142	(4 credits)	Electromagnetism and Optics

Students may write McGill Placement Tests to obtain credit for CHEM 110, CHEM 120, MATH 140, MATH 141, MATH 133, PHYS 131 and PHYS 142, 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.

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, 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 Ordre 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.

For more information, visit the Websites of the Ordre des ingénieurs du Québec, www.oiq.qc.ca and of the Canadian Council of Professional Engineers, www.ccpe.ca.

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 by the Faculty. Written notification will be forwarded to the student and he/she will be permitted to revise his/her course selection.

Those students who have received advance credits/exemptions or passed a placement exam, and are blocked from registration into 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.

3.4 Complementary Studies

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

(i) One 3-credit course on the impact of technology on society.

(ii) One 3-credit course in the humanities and social sciences, administrative studies and law.

The three credits under (i) are to be chosen from the following list of courses which relate to the impact of technology on society.

CHEE 230	Environmental Aspects of Technology
CHEE 430	Technology Impact Assessment
CIVE 469	Infrastructure and Society
ECON 225	Economics of the Environment
ENVR 201	Society and Environment
GEOG 200	Geographical Perspectives: World Environmental Problems
GEOG 203	Environmental Systems
GEOG 205	Global Change: Past, Present and Future
GEOG 302	Environmental Management 1
MIME 308	Social Impact of Technology
PHIL 343	Biomedical Ethics
SOCI 235	Technology and Society
SOCI 312	Industrial Sociology

The course(s) under (ii) are to be chosen from:

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 ECON 208, ECON 217, ECON 227, ECON 259 and ECON 337)
- History (Subject Code HIST)
- Philosophy (excluding PHIL 210)
- Political Science (Subject Code POLI)
- Psychology (excluding PSYC 204, PSYC 305 and PSYC 435 but including PSYC 100)
- Religious Studies (Subject Code RELG)
- School of Social Work (Subject Code SWRK)
- Sociology (excluding SOCI 350)

or ARCH 350 The Material Culture of Canada
or ENVR 203 Knowledge, Ethics and Environment
or ENVR 400 Environmental Thought
or MATH 338 History and Philosophy of Mathematics

B. Administrative Studies and Law

Faculty of Engineering

FACC 220 Law for Architects and Engineers

Faculty of Management

(Management courses have limited enrolment and registration dates, see Calendar of Dates.)

BUSA 465	Technological Entrepreneurship
INDR 294	Introduction to Labour-Management Relations
MGCR 222	Introduction to Organizational Behaviour
MGCR 320	Managing Human Resources
MGCR 352	Marketing Management 1
MGCR 360	Social Context of Business
MRKT 360	Marketing of Technology
ORGB 321	Leadership

C. Language Courses

Any language course which is deemed by the academic advisor 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.

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.

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	J	Unexcused Absence
B+, B, B-	Good	K	Incomplete
C+, C	Satisfactory	KF	Incomplete Failed
D	Conditional Pass	L	Deferred
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 J indicates an unexcused failure to submit assignments or an unexcused absence from an examination. It is equivalent to an F grade.

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 31st (January 15th for Winter graduation); for Winter term courses it is August 15th (May 15th for Spring graduation) and for Summer term courses it is December 1st (October 1st 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.

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 added manually to a student's record after the Drop/Add deadline or once a mark has been submitted by the Faculty. 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 complementaries" or "architectural complementaries", 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.

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.

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.

3.5.5 Grade Point Averages and Extra Courses

The Faculty calculates a term grade point average (TGPA). Any courses taken which lie outside the program are classified as extra, are indicated by an "X" on transcripts and do not affect the grade point average. Students must receive departmental approval for such courses, and the course must be identified and recorded prior to writing the final examination.

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, but 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. A request for readmission must be made in writing in a letter addressed to the Associate Dean, Student Affairs in the Student Affairs Office. If readmitted, the student will be placed back on Probationary Standing. Students will remain on probationary standing until they achieve a CGPA greater 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 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 pro-

gram 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.

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 department 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.

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.

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.

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 (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 supplementals;
– 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), Engineering, is required if a student wishes to write supplemental exams totaling 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 find out the date and time of the supplemental exam. 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 1st for Fall courses and July 15th for Winter courses and courses spanning Fall/Winter courses.

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.

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 course work 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. Students are to ONLY write the final examination but NOT re-do or re-submit course material. If they wish to resubmit assignments and/or rewrite quizzes, class tests and/or midterms, they must appeal to the Associate Dean, Student Affairs.

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 coursework 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.
For *Engineering* and *Management* courses, students granted a deferral MUST write the final exam the NEXT time it is offered. Students should be aware that a deferred examination might not be available until the next time the course is given (one year or longer).

For *Arts* and *Science* courses, students MUST write the supplemental examination offered during either May (for Fall courses) or August (for Winter courses). Consult the Calendar of Dates for the dates set for supplemental exams, and the supplemental examination schedule posted on the Web for the exact date and time of a specific exam. Please note deferrals are not permitted for summer courses. Students may be permitted to withdraw from a course without refund instead.

For Continuing Education courses, students granted a deferral should contact the Centre for Continuing Education directly for more information.

For further information, refer to "Deferred Examinations" on page 36.

4 Academic Programs

The curricula described in the following pages, and the courses listed under Faculty of Engineering, see page 437, have been approved for the 2003-04 session, but the Faculty reserves the right to introduce changes as may be deemed necessary or desirable.

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 Professor
Harold Spence-Sales; A.A.Dipl., M.R.T.P.I., F.C.I.P.

Professors
Bruce Anderson; B.Arch.(McG.), M.Arch.(Harv.), F.R.A.I.C., O.A.Q.
Vikram Bhatt; N.Dip.Arch.(Ahmedabad), M.Arch.(McG.), M.R.A.I.C.
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.Q., 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.
Radoslav Zuk; B.Arch.(McG.), M.Arch.(M.I.T.), D.Sc. (Ukr.Acad.Art), F.R.A.I.C., F.R.S.A., F.A.R.C., O.A.Q., O.A.A.

Associate Professors
Annmarie 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.
Robert Mellin; B.Arch., M.Sc.(Arch.)(Penn.State), M.Arch.(McG.), M.Sc., Ph.D.(U.Penn.), M.R.A.I.C., N.A.A.
Pieter Sijpkes; B.Sc.(Arch.), B.Arch.(McG.)

Course Lecturers
Manon Asselin, Patrice Bégin, Jean D'Aragon, Maxime Gagné, Simon Jones, Richard Klopp, Marie-Paule MacDonald, David Theodore, Lise Tremblay, Roland Ulfig

Adjunct Professors
Cécile Baird, Ewa Bieniecka, Lawrence Bird, Julia Bourke, Michael Carroll, Nathalie David, Howard Davies, Georges Drolet, Gordon Edwards, François Émond, Julia Gersovitz, Dan Hanganu, Phyllis Lambert, Seymour Levine, Anna Mainella, Harry Mayerovitch, Serge Melanson, Rosanne Moss, Carl Mulvey, Joanna Nash, Louise Pelletier, Mark Poddubiuk, Louis Pretty, Daniella Rohan, Jacques Rousseau, Richard Russell, Robert Stanley, Samson Yip, Jozef Zorko

Research Associates
Jim Donaldson, Rafik Salama

Associate Members
Clarence Epstein, Tania Martin, Irena Murray, Howard Schubert

Visiting Critics and Lecturers
Each year visitors are involved in the teaching of certain courses as lecturers and critics. These visitors change from year to year; in 2002, they were:
Chuck Adler, Gavin Affleck, Gilles Arpin, Dino Barbarese, Barry Bell, Myriam Blais, Sheryl Boyle, Louis Brillant, Peter Busby, Ravof Butros, Yvan Cabazon, Gregory Caicco, Mario Carpo, Lily Chi, Denis Claremont, Jimalee Dakin, Luis de Miguel, José Di Bona, Josée Dionne, Julie Dionne, François Dufaux, Miguel Escobar, Marc Fauteux, Marta Franco, Stanislaus Fung, Ronald Gagnon, Alex Grabowski, Thomas Green, Katja Maria Grillner, Bob Hamilton, Nora Hanessian, Jacques Herzog, Mitch Hill, Robert Kastelic, Ben Katchor, Donald Kunze, Catherine Lapierre, Irena Latek, Jean-Guy Lecat, Catherine LeGrand, Frank McMahon, Vouli Mamfredis, Eric Marosi, Brian Massumi, Nadia Meratla, André Meunier, Josette Michaud, Katsu Muramoto, Fred Ohmicien, Juhani Pallasmaa, Steve Parcell, Alina Payne, Daniel Pearl, Christie Pearson, Mark Pimlott, François Racine, Susan Ross, John Schweitzer, Jean-Pierre Smith, Laurent Stalder, Sudhir Suri, Sheila Theophanides, Nicole Valois, Fred Weiser, Andrea Wolff, Katherine Young.

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 (CACB), 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.

Masters 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 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 (CACB), 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; École d'architecture de Grenoble, Grenoble, France; École d'architecture Clermont-Ferrand, Clermont-Ferrand, France.

ANCILLARY ACADEMIC FACILITIES

Laboratories and Workshops

Architectural Workshops – David Speller, Technician.

Communications Laboratory, including Photo Lab – Professor Ricardo Castro.

Computers in Architecture Laboratory and the Apple Design and Modeling Centre – Professors Robert Mellin and Richard Russell.

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 – Irena Murray.

Orson Wheeler Architectural Model Collection – Professor Pieter Sijpkes.

Materials Resource Centre – Dr. Avi Friedman.

CURRICULUM FOR THE B.Sc.(Arch.) DEGREE

[Program revisions are under consideration for September 2003. Go to www.mcgill.ca (Course Calendars) in July for details.]

REQUIRED COURSES		COURSE CREDIT	
Non-Departmental Subjects			
CIVE 205	Statics	3	
CIVE 283	Strength of Materials	4	
CIVE 385*	Structural Steel and Timber Design	3	
CIVE 388*	Foundations and Concrete Design	3	
CIVE 492*	Structures	2	
FACC 220	Law for Architects and Engineers	3	
MIME 310	Engineering Economy	3	**21**

* 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			
ARCH 201	Communication, Behaviour and Architecture	6	
ARCH 202	Architectural Graphics and Design Elements	6	
ARCH 217	Freehand Drawing 1	1	
ARCH 218	Freehand Drawing 2	1	
ARCH 240	Organization of Materials in Building	3	
ARCH 250	Architectural History 1	3	
ARCH 251	Architectural History 2	3	
ARCH 303	Design and Construction 1	6	
ARCH 304	Design and Construction 2	6	
ARCH 321	Freehand Drawing 3	1	
ARCH 322	Freehand Drawing 4	1	
ARCH 324	Sketching School 1	1	
ARCH 375	Landscape	2	
ARCH 405	Design and Construction 3	6	
ARCH 406	Design and Construction 4	6	
ARCH 447	Electrical Services	2	
ARCH 451	Building Regulations and Safety	2	**56**
COMPLEMENTARY COURSES			**12**

Students must complete 12 credits of architectural complementaries 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.

A. History	B. Theory	C. Environmental Design	D. Technics
ARCH 372	ARCH 352	ARCH 350	ARCH 318
ARCH 379	ARCH 363	ARCH 378	ARCH 319
ARCH 388	ARCH 383	ARCH 379	ARCH 364
ARCH 522	ARCH 524	ARCH 520	ARCH 377
ARCH 523	ARCH 525	ARCH 521	ARCH 461
ARCH 528	ARCH 529	ARCH 527	ARCH 471
ARCH 531		OCC1 442	ARCH 526
ARCH 532			
ARCH 533			

OUTSIDE ELECTIVES		**6**
6 credits must be completed outside the School of Architecture, subject to approval by the Student Advisor.		
TOTAL CREDITS		**95**

Architectural Complementaries

ARCH 252	(3)	Introduction to Architectural History 1
ARCH 253	(3)	Introduction to Architectural History 2
ARCH 318	(3)	Design Sketching
ARCH 319	(3)	The Camera and Perception
ARCH 350	(3)	The Material Culture of Canada
ARCH 352	(3)	Art and Theory of House Design
ARCH 364	(2)	Architectural Modeling
ARCH 372	(2)	History of Architecture in Canada
ARCH 377	(2)	Energy, Environment and Buildings
ARCH 378	(3)	Site Usage
ARCH 379	(4)	Summer Course Abroad
ARCH 383	(3)	Geometry/Architecture/Environment

ARCH 388	(2)	Introduction to Historic Preservation
ARCH 461	(1)	Freehand Drawing and Sketching
ARCH 471	(2)	Computer-Aided Building Design
ARCH 490	(2)	Selected Topics in Design
ARCH 520	(3)	Montreal: Urban Morphology
ARCH 521	(3)	Structure of Cities
ARCH 522	(3)	History of Domestic Architecture in Quebec
ARCH 523	(3)	Significant Texts and Buildings
ARCH 524	(3)	Seminar on Architectural Criticism
ARCH 525	(3)	Seminar on Analysis and Theory
ARCH 526	(3)	Philosophy of Structure
ARCH 527	(3)	Civic Design
ARCH 528	(3)	History of Housing
ARCH 529	(3)	Housing Theory
ARCH 531	(3)	Architectural Intentions Vitruvius - Renaissance
ARCH 532	(3)	Origins of Modern Architecture
ARCH 533	(3)	New Approaches to Architectural History
ARCH 540	(3)	Selected Topics in Architecture 1
ARCH 541	(3)	Selected Topics in Architecture 2
OCC1 442	(2)	Enabling Environments

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

Chair — Richard J. Munz

Post-Retirement
J.-M. Charrier; Dipl.Ing., E.N. S.A.M.(Paris), M.S.,Ph.D.(Akron), Ing.
W.J. Murray Douglas; B.Sc.(Qu.), M.S.E., Ph.D.(Mich.)

Professors
David G. Cooper; B.Sc., Ph.D.(Tor.)
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.
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)*
Juan H. Vera; B.Mat.(Chile), Ing.Quim.(U.T.E.), M.S.(Berkeley), Dr.Ing.(Santa Maria), Ing.
Bohumil Volesky; M.Sc.(Czech. Tech. Univ.), Ph.D.(W.Ont.)
Martin E. Weber; B.S.E.(Prin.), Sc.D.(M.I.T.), P.Eng.

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

Assistant Professors
Wayne A. Brown; B.Eng., M.Eng., Ph.D.(McG.)
Sylvain Coulombe; B.Sc., M.Eng.(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.)
Sasha Omanovic; B.Sc., Ph.D. (Zagreb)

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

Adjunct Professors
Andrejs Beils, Claude Belanger, Pierre Bisaillon, Richard Campeau, Peter Csakany, Mario Davidovsky, Dennis Dionne, France Dubuc, Gil Garnier, Serge Guiot, Mark Hollingworth, Bing Huang, David Juck, David J. McKeagan, Carlos Miguez, Arun S. Mujumdar, Patrice Nadeau, Raman Nayar, Norman Peters, Marc Renaud, Bassam Sarkis, John Sarlis, Jana Simandl, Armen Tasan, Roger C. Urquhart, Leszek A. Utracki, Paula Wood-Adams.

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, experimenting, 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 CHEM 212 or CHEM 234, respectively (Introductory 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 3.1.2 "Basic Science Requirements for Students Entering 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 discuss this with their advisor.

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 passing grade in other complementary courses and in any elective courses taken.

CURRICULUM FOR THE B.ENG. DEGREE IN CHEMICAL ENGINEERING

REQUIRED COURSES		COURSE CREDIT	
Non-Departmental Courses			
CHEM 212	Introductory Organic Chemistry 1	4	
CHEM 233	Topics in Physical Chemistry	3	
CHEM 234	Topics in Organic Chemistry	3	
COMP 208	Computers in Engineering	3	
MATH 260	Intermediate Calculus	3	
MATH 261	Differential Equations	3	
MATH 265	Advanced Calculus	3	
MIME 221	Engineering Professional Practice	2	
MIME 310	Engineering Economy	3	**27**
Chemical Engineering Courses			
CHEE 200	Introduction to Chemical Engineering	4	
CHEE 204	Chemical Manufacturing Processes	3	
CHEE 220	Chemical EngineeringThermodynamics	3	
CHEE 291	Instrumental Measurements Laboratory	4	
CHEE 314	Fluid Mechanics	4	
CHEE 315	Heat and Mass Transfer	4	
CHEE 340	Process Modelling	3	
CHEE 351	Separation Processes	3	
CHEE 360	Technical Paper 1	1	
CHEE 370	Elements of Biotechnology	3	
CHEE 380	Materials Science	3	
CHEE 392	Project Laboratory 1	4	
CHEE 393	Project Laboratory 2	5	
CHEE 423	Chemical Reaction Engineering	4	
CHEE 453	Process Design	4	
CHEE 455	Process Control	4	
CHEE 456	Design Project 1	1	
CHEE 457	Design Project 2	5	
CHEE 462	Technical Paper 2	1	
CHEE 474	Biochemical Engineering	3	
CHEE 484	Materials Engineering	3	**69**
COMPLEMENTARY COURSES			
Courses to be selected from those approved by the Department (see list of technical complementaries below)			**9**
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 3.4 "Complementary Studies" for further information.			**6**
TOTAL			**111**

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

Term 1		**Credits**	
CHEE 200	Introduction to Chemical Engineering	4	
CHEE 291	Instrumental Measurement Laboratory	4	
CHEM 212	Introductory Organic Chemistry 1	4	
MATH 260	Intermediate Calculus	3	
MIME 221	Engineering Professional Practice	2	**17**
Term 2			
CHEE 204	Chemical Manufacturing Processes	3	
CHEE 220	Chemical EngineeringThermodynamics	3	
CHEM 234	Topics in Organic Chemistry	3	
COMP 208	Computers in Engineering	3	
MATH 261	Differential Equations	3	**15**

Students entering their second year of study or who are starting in January must plan their program of studies in consultation with their departmental advisor.

Additional information can be found on the Faculty Website at www.mcgill.ca/engineering, as well as in section 3.1.2 "Basic 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 Department. The purpose of this requirement is to provide students with an area of specialization within the broad field of chemical engineering. Alternatively, some students use the technical complementaries to increase the breadth of their chemical engineering training.

At least two (2) technical complementary courses are to be selected from those offered by the Department (list below). Permission 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::

BIOT 505	Selected Topics in Biotechnology (Biotechnology Minor students only)
CHEE 363	Projects Chemical Engineering 1
CHEE 438	Engineering Princples in Pulp and Paper Processes
CHEE 452	Particulate Systems
CHEE 458	Computer Applications
CHEE 464	Projects in Chemical Engineering 2
CHEE 471	Industrial Water Pollution Control (or CIVE 430)
CHEE 472	Industrial Air Pollution Control (or MECH 534)
CHEE 481	Polymer Engineering
CHEE 487	Chemical Processing Electronics Industry
CHEE 494	Research Project and Seminar
CHEE 495	Research Project and Seminar
CHEE 571	Small Computer Applications: Chemical Engineering
CHEE 581	Polymer Composites Engineering

Courses CHEE 481 and CHEE 581 comprise a Polymeric Materials sequence. Additional courses in this area are available in the Chemistry Department (e.g., CHEM 455) or at the graduate level (CHEE 681 to CHEE 684). The Department has considerable expertise in the polymer area.

Courses CHEE 370 and CHEE 474 make up a sequence in Biochemical 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 biochemistry and microbiology. The food, beverage and pharmaceutical industries are large industries in the Montreal area and these courses are relevant to these industries and to the new high technology applications of biotechnology.

The third area in which there is a sequence of courses is Pollution Control. The Department offers two courses in this area: CHEE 471 and CHEE 472. As some water pollution control problems are solved by microbial processes, course CHEE 474 is also relevant to the pollution control area. Likewise as the solution to pollution problems frequently involves removal of particulate matter from gaseous or liquid streams, course CHEE 452 is also relevant. Additional courses in this area are listed under section 5.7 "Environmental Engineering Minor".

A Minor in Biotechnology is also offered in the Faculties of Engineering and of Science with emphasis on Molecular Biology and Chemical Engineering Processes. A full description of the program appears in section 5.2 "Biotechnology Minor".

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

ELECTIVE COURSES

Students who have obtained exemptions for courses, i.e., for CEGEP courses equivalent to CHEM 212 or CHEM 234, or who take more than the minimum requirements for the degree, may

choose university-level courses in any field. Approval of an elective course requires only that no timetable conflicts are created and that it not be a repetition of material already covered in the curriculum or already mastered by the student.

CURRICULUM COMMITTEE

The Curriculum Committee is composed of three students, elected by their classes, and two staff members. This Committee provides a forum for all matters involving undergraduate student/staff interactions. While the primary concern is with matters of curriculum and courses (their content, evaluation, scheduling, etc.), the Committee has also taken up a number of other matters in recent years, e.g., working space, facilities (equipment and libraries), etc.

CANADIAN SOCIETY FOR CHEMICAL ENGINEERING

The Chemical Engineering Student Society has for many years been affiliated both with the CSChE (Canadian Society for Chemical Engineering) and with the AIChE (American Institute of Chemical Engineers). For a nominal fee students receive *Canadian Chemical News*, a monthly publication, and the AIChE Student Members Bulletin as well as other privileges of student membership in the two societies. The student chapter also organizes a series of local social, educational and sporting events. For example, recent events have included student-professor banquets and Christmas parties, dances, speakers, broomball games and joint meetings with the Montreal Section of the CSChE. The latter gives students a chance to mix with practising chemical engineers.

4.3 Department of Civil Engineering and Applied Mechanics

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Chair — Denis Mitchell

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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.
M. Saeed Mirza; B.Eng.(Karachi), M.Eng., Ph.D.(McG.), F.A.C.I., F.E.I.C., F.C.S.C.E., Hon. F.I.E.P., Eng.
Denis Mitchell; B.A.Sc., M.A.Sc., Ph.D.(Tor.), F.A.C.I., F.C.A.E., F.C.S.C.E., Eng. *(William Scott Professor of Civil Engineering)*
Van-Thanh-Van Nguyen; B.M.E.(Vietnam), M.C.E.(A.I.T.), D.A.Sc.(Montr.), Eng.
A. Patrick S. Selvadurai; M.S.(Stan.), Ph.D., D.Sc.(Nottingham), F.E.I.C., F.I.M.A., F.C.S.C.E., P.Eng.
Suresh C. Shrivastava; B.Sc.(Eng.) (Vikram), M.C.E.(Del.), Sc.D.(Col.), Eng.

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Ronald Gehr; B.Sc.(Eng.)(Rand), M.A.Sc.,Ph.D.(Tor.), P.Eng.
Ghyslaine McClure; B.Ing.(Montr.), S.M.C.E.(M.I.T.), Ph.D.(Montr.), Eng.
James Nicell; B.A.Sc., M.A.Sc., Ph.D.(Windsor), P.Eng. *(William Dawson Scholar)*
Yixin Shao; B.S., M.S.(Tongji), Ph.D.(Northwestern)

Assistant Professors
Susan J. Gaskin; B.Sc.(Queen's), Ph.D. (Canterbury)
Subhasis Ghoshal; B.C.E. (Jadavpur), M.S.(Missouri), Ph.D.(Carnegie Mellon)
Murtaza Haider; B.Sc.(Peshawar), M.A.Sc., Ph.D.(Tor.) *(joint appoint. with School of Urban Planning)*
Colin Rogers; B.A.Sc.(Waterloo), M.A.Sc., Ph.D.(Sydney), P.Eng.

Adjunct Professors
Sofia Barbarutsi, Jean Pierre Desmarais, Serge Guiot, John Hadjinicolaou, Jalal Hawari, Paul Henshaw, Graham Holder, Emmanuel Le Colletter, Zoubir Lounis, Kenneth MacKenzie, Charles Manatakos, Thanh Son Nguyen, Paul Rodrigue, Sandro Scola, William Taylor, Jan Vrana, Monica Wagner, Adel Zaki, Ronald Zaloum

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 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.

Experience has shown that graduates of the program who choose to pursue advanced studies elsewhere receive favourable consideration by all the leading universities in North America and abroad.

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 advisor each term to confirm the courses for which they are registered.

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

CURRICULUM FOR THE B.ENG. DEGREE IN CIVIL ENGINEERING

REQUIRED COURSES			COURSE CREDIT
Non-departmental courses			
COMP 208	Computers in Engineering	3	
EDEC 206	Communication in Engineering	3	
EPSC 221	General Geology	3	
MATH 260	Intermediate Calculus	3	
MATH 261	Differential Equations	3	
MATH 265	Advanced Calculus	3	
MECH 261	Measurement Laboratory	2	
MECH 290	Graphics 2	3	
MIME 221	Engineering Professional Practice	2	
MIME 310	Engineering Economy	3	**28**
Departmental courses			
CIVE 202	Construction Materials	4	
CIVE 205	Statics	3	
CIVE 206	Dynamics	3	
CIVE 207	Solid Mechanics	4	
CIVE 208	Civil Engineering Systems Analysis	3	
CIVE 210	Surveying	2	
CIVE 225	Environmental Engineering	4	
CIVE 290	Thermodynamics and Heat Transfer	3	
CIVE 302	Probabilistic Systems	3	
CIVE 311	Geotechnical Mechanics	4	
CIVE 317	Structural Engineering 1	3	
CIVE 318	Structural Engineering 2	3	
CIVE 319	Transportation Engineering	3	
CIVE 320	Numerical Methods	4	
CIVE 323	Hydrology and Water Resources	3	
CIVE 324	Construction Project Management	3	
CIVE 327	Fluid Mechanics and Hydraulics	4	
CIVE 418	Design Project	3	
CIVE 432	Technical Paper	1	**60**
COMPLEMENTARY COURSES			
A minimum of six credits to be selected from list (a) and the remaining nine credits to be slected from lists (a) or (b) or from other suitable undergraduate or 500-level courses.			**15**
(a) Design Technical Complementaries			
CIVE 416	(3)	Geotechnical Engineering	
CIVE 421	(3)	Municipal Systems	
CIVE 428	(3)	Water Resources and Hydraulic Engineering	
CIVE 462	(3)	Design of Steel Structures	
CIVE 463	(3)	Design of Concrete Structures	
(b) General Technical Complementaries			
CIVE 430	(3)	Water Treatment and Pollution Control	
CIVE 433	(3)	Urban Planning	
CIVE 440	(3)	Traffic Engineering	
CIVE 446	(3)	Construction Engineering	
CIVE 451	(3)	Geoenvironmental Engineering	
CIVE 460	(3)	Matrix Structural Analysis	
CIVE 470	(3)	Research Project	
CIVE 512	(3)	Advanced Civil Engineering Materials	
CIVE 514	(3)	Structural Mechanics	
CIVE 526	(3)	Solid Waste Management	
CIVE 527	(3)	Renovation and Preservation: Infrastructure	
CIVE 540	(3)	Urban Transportation Planning	
CIVE 541	(3)	Rail Engineering	
CIVE 550	(3)	Water Resources Management	
CIVE 553	(3)	Stream Pollution and Control	
CIVE 555	(3)	Environmental Data Analysis	
CIVE 570	(3)	Waves and Costal Engineering	
CIVE 572	(3)	Computational Hydraulics	
CIVE 573	(3)	Hydraulic Structures	
CIVE 574	(3)	Fluid Mechanics of Water Pollution	
CIVE 576	(3)	Hydrodynamics	
CIVE 577	(3)	River Engineering	
CIVE 579	(3)	Water Power Engineering	
CIVE 585	(3)	Groundwater Hydrology	
CIVE 586	(3)	Earthwork Engineering	
CIVE 587	(3)	Pavement Design	
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 3.4 "Complementary Studies" for further information.			**6**
TOTAL CREDITS			**109**

4.4 Department of Electrical and Computer Engineering

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Associate Chair — Jonathan P. Webb

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

Post-Retirement
Maier L. Blostein; B.Eng., M.Eng.(McG.), Ph.D.(Ill.), F.I.E.E.E., Eng.
Clifford H. Champness; M.Sc.(Lond.), Ph.D.(McG.
Nicholas C. Rumin; B.Eng., M.Sc., Ph.D.(McG.), Eng.

Professors
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Peter E. Caines; B.A.(Oxon.), D.I.C. Ph.D.(Lond.), F.I.E.E.E., F.C.I.A.R.
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Geza Joos; B.Sc.(C'dia), M.Eng. Ph.D.(McG.)
Peter Kabal; B.A.Sc., M.A.Sc., Ph.D.(Tor.)
Tho Le-Ngoc; M.Eng.(McG.), Ph.D.(Ott.), F.I.E.E.E.
Harry Leib; B.Sc.(Technion), Ph.D.(Tor.)
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David A. Lowther; B.Sc.(Lond.), Ph.D.(C.N.A.A.), F.C.A.E., Eng.
Boon-Teck Ooi; B.E.(Adel.), S.M.(M.I.T.), Ph.D.(McG.), Eng.
Gordon Roberts; B.A.Sc.(Wat.), M.A.Sc., Ph.D.(Tor.), Eng.
(James McGill Professor)
Jonathan Webb; B.A., Ph.D.(Cantab.)

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James Clark; B.Sc., Ph.D.(Br.Col.)
Frank Ferrie; B.Eng., Ph.D.(McG.)
Vincent Hayward; Dip.d'Ing.(ENSM, Nantes), Doc.Ing.(Orsay), Eng.
Steve McFee; B.Eng., Ph.D.(McG.)

Hanna Michalska; B.Sc., M.Sc.(Warsaw), Ph.D.(Lond.)
David V. Plant; M.S., Ph.D.(Brown) *(James McGill Professor)*
Ishiang Shih; M.Eng., Ph.D.(McG.)

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Tal Arbel; M.Eng., Ph.D.(McG.)
Jan Bajcsy; B.Sc.(Harv.), M.Eng., Ph.D.(Prin.)
Benoit Boulet; B.Sc.(Laval), M.Eng.(McG.) Ph.D.(Tor.)
Lawrence Chen, B.Eng.(McG.), M.A.Sc., Ph.D.(Tor.)
Mark Coates; B.Eng.(Australia), Ph.D.(Cambridge)
Jeremy R. Cooperstock; A.Sc.(U.B.C.), M.Sc., Ph.D.(Tor.)
Mourad El-Gamal; B.Sc.(Cairo), M.Sc.(Nashville), Ph.D.(McG.)
Dennis Giannacopoulos; M.Eng., Ph.D.(McG.)
Andrew Kirk; B.Sc.(Brist.), Ph.D.(London) *(William Dawson Scholar)*
Fabrice Labeau, M.S., Ph.D.(Louvain)
Radu Negulescu; M.Sc.(Romania), M.Sc.(France), Ph.D.(Waterloo)
Milica Popovich; B.Sc.(Colo.), M.Sc., Ph.D.(Northwestern)
Ioannis Psaromiligkos; B.Sc.(Patras), M.Sc., Ph.D.(Buffalo)
Zilic Zeljko; B.Eng.(Zagreb), M.S.c, Ph.D.(Tor.)

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

Lecturers
Kenneth L. Fraser; B.Eng., M.Eng.(McG.), Eng.
Danny Grant; M.Eng., Ph.D.(McG.)
Richard Vickers; B.Sc.(Wales)

Associate Members
Martin Buehler; M.Sc., Ph.D.(Yale)
Philipe Depalle; D.E.A.(Le Mans & ENS Cachan, Ph.D.(Le Mans & IRCAM)
Gregory Dudek; B.Sc.(Queen's), M.Sc., Ph.D.(Tor.)
Alan C. Evans; M.Sc.(Surrey), Ph.D.(Leeds)
William R. Funnell; M.Eng., Ph.D.(McG.)
Henrietta L. Galiana; M.Eng., Ph.D.(McG.)
Jean Gotman; M.E.(Dartmouth, N.S.), Ph.D.(McG.)
Robert E. Kearney; M.Eng., Ph.D.(McG.)
Bruce Pike; M.Eng., Ph.D.(McG.)
Bernard Segal; B.Sc., B.Eng., M.Eng., Ph.D.(McG.)

Adjunct Professors
Ray Bartnikas, Eduard Cerny, Charalambos Charalambous, Cedric Guss, Maurice Huneault, Cheng K. Jen, Michael Kaplan, Karim Khordoc, Irene Leszkowicz, Miguel Marin, Donald McGillis, Douglas O'Shaughnessy, Norbert Puetz, Farouk Rizk, Lucjan Wegrowicz.

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 professorial 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 "Computer Science (COMP)" on page 269.]

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 enrollment program and entry is highly competitive. There is no direct entry to the Honours program in the first year. Students may enter the Honours Program in the following ways:

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

MATH 325	Ordinary Differential Equations	instead of MATH 261
MATH 247	Linear Algebra	instead of MATH 270
MATH 248	Advanced Calculus 1	instead of MATH 265
MATH 249	Advanced Calculus 2	instead of MATH 381
PHYS 251	Classical Mechanics 1	instead of CIVE 281

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 and maintained a CGPA of at least 3.00 since entering Electrical and Computer Engineering. For more information, please contact the Departmental office at (514) 398-7344.

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

REQUIRED COURSES		COURSE CREDIT
Non-Departmental Courses		
COMP 202	Introduction to Computing 1	3
EDEC 206	Communication in Engineering	3
MATH 260	Intermediate Calculus	3
MATH 247*	Linear Algebra	3
or MATH 270	Applied Linear Algebra (3)	
MATH 248*	Advanced Calculus 1	3
or MATH 265	Advanced Calculus (3)	

MATH 249	Advanced Calculus 2	3	
or MATH 381	Complex Variables and Transforms (3)		
MATH 325	Ordinary Differential Equations	3	
or MATH 261	Differential Equations (3)		
MIME 221	Engineering Professional Practice	2	
MIME 310	Engineering Economy	3	
PHYS 251	Classical Mechanics 1	3	
or CIVE 281	Analytical Mechanics (3)		
PHYS 271	Quantum Physics	3	**32**

** CGPA of 3.30 is required to register for MATH 247 and MATH 248.*

Departmental Courses

ECSE 200	Fundamentals of Electrical Engineering	3	
ECSE 210	Circuit Analysis	3	
ECSE 221	Introduction to Computer Engineering	3	
ECSE 291	Electrical Measurements Laboratory	2	
ECSE 303	Signals and Systems 1	3	
ECSE 304	Signals and Systems 2	3	
ECSE 305	Probability and Random Sig. 1	3	
ECSE 322	Computer Engineering	3	
ECSE 323	Digital System Design	5	
ECSE 330	Introduction to Electronics	3	
ECSE 334	Introduction to Microelectronics	5	
ECSE 351	Electromagnetic Fields	3	
ECSE 352	EM Waves and Optics	3	
ECSE 361	Power Engineering	3	
ECSE 498	Honours Thesis 1	3	
ECSE 499	Honours Thesis 2	3	**51**

COMPLEMENTARY COURSES

Technical Complementaries **15**

Five technical complementary courses (15 credits), which must be ECSE courses at the 500 level (or ECSE 427, ECSE 451). 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 (ECSE 498 and ECSE 499) 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

ECSE 427	Operating Systems
ECSE 525	Computer Architecture
ECSE 532	Computer Graphics
ECSE 548	Introduction to VLSI Systems

Control and Automation

ECSE 501	Linear Systems
ECSE 502	Control Engineering
ECSE 503	Linear Stochastic Systems 1
ECSE 504	Computer Control
ECSE 505	Nonlinear Control Systems
ECSE 507	Optimization and Optimal Control
ECSE 509	Probability and Random Sig. 2
ECSE 512	Digital Signal Processing 1
ECSE 529	Image Processing and Communication
ECSE 531	Real Time Systems

Integrated Circuits and Electronics

ECSE 522	Asynchronous Circuits and Systems
ECSE 527	Optical Engineering
ECSE 530	Logic Synthesis
ECSE 533	Physical Basis of Semiconductor Devices
ECSE 534	Analog Microelectronics
ECSE 545	Microelectronics Technology
ECSE 548	Introduction to VLSI Systems
ECSE 571	Optoelectronic Devices
ECSE 573	Microwave Electronics

Power Engineering

ECSE 502	Control Engineering
ECSE 549	Expert Systems in Electrical Design
ECSE 559	Flexible AC Transmission Systems
ECSE 560	Power Systems Analysis 2
ECSE 563	Power Systems Operation and Planning
ECSE 565	Introduction to Power Electronics

Telecommunications

ECSE 451	EM Transmission and Radiation
ECSE 509	Probability and Random Sig. 2
ECSE 511	Introduction to Digital Communication
ECSE 512	Digital Signal Processing 1
ECSE 521	Digital Communications 1
ECSE 523	Speech Communications
ECSE 527	Optical Engineering
ECSE 528	Telecommunication Network Architecture
ECSE 571	Optoelectronic Devices
ECSE 596	Optical Waveguides

Laboratory Complementaries **4**

Two of the following eleven 400-level laboratory courses:

ECSE 426	Microprocessor Systems
ECSE 431	Introduction to VSLI CAD
ECSE 435	Mixed-Signal Test Techniques
ECSE 485	IC Fabrication Laboratory
ECSE 486	Power Laboratory
ECSE 487	Computer Architecture Laboratory
ECSE 488	High Frequency Laboratory
ECSE 490	Digital Signal Processing Laboratory
ECSE 491	Communication Systems Laboratory
ECSE 492	Optical Communications Laboratory
ECSE 493	Control and Robotics Laboratory

General Complementaries **6**

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 3.4 "Complementary Studies" for further information.

TOTAL CREDITS **108**

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

REQUIRED COURSES		**COURSE CREDIT**	
Non-Departmental Courses			
CIVE 281	Analytical Mechanics	3	
or PHYS 251	Classical Mechanics 1 (3)		
COMP 202	Introduction to Computing 1	3	
EDEC 206	Communication in Engineering	3	
MATH 260	Intermediate Calculus	3	
MATH 261	Differential Equations	3	
or MATH 325	Ordinary Differential Equations (3)		
MATH 265	Advanced Calculus	3	
or MATH 248*	Advanced Calculus 1 (3)		
MATH 270	Applied Linear Algebra	3	
or MATH 247*	Linear Algebra (3)		
MATH 381	Complex Variables and Transforms	3	
MIME 221	Engineering Professional Practice	2	
MIME 310	Engineering Economy	3	
PHYS 271	Quantum Physics	3	**32**

** CGPA of 3.30 is required to register for MATH 247 and MATH 248.*

Departmental Courses

ECSE 200	Fundamentals of Electrical Engineering	3	
ECSE 210	Circuit Analysis	3	
ECSE 221	Introduction to Computer Engineering	3	
ECSE 291	Electrical Measurements Laboratory	2	
ECSE 303	Signals and Systems 1	3	
ECSE 304	Signals and Systems 2	3	
ECSE 305	Probability and Random Sig. 1	3	
ECSE 322	Computer Engineering	3	
ECSE 323	Digital System Design	5	
ECSE 330	Introduction to Electronics	3	
ECSE 334	Introduction to Microelectronics	5	
ECSE 351	Electromagnetic Fields	3	
ECSE 352	EM Waves and Optics	3	
ECSE 361	Power Engineering	3	
ECSE 494	Electrical Engineering Design Project	3	**48**

COMPLEMENTARY COURSES

Technical Complementaries **18**

Six courses (18 credits) from the list of 400-level courses in Electrical Engineering that must include 9 credits (3 courses) from one of the areas of specialization listed below:

Computer Systems Technology

ECSE 424 Human-Computer Interaction
ECSE 425 Computer Organization and Architecture
ECSE 427 Operating Systems

Control and Automation

ECSE 404 Control Systems
ECSE 412 Discrete Time Signal Processing
ECSE 426 Microprocessor Systems

Integrated Circuits and Electronics

ECSE 425 Computer Organization and Architecture
ECSE 431 Introduction to VSLI CAD
ECSE 432 Physical Basis: Transistor Devices
ECSE 435 Mixed-Signal Test Techniques

Phototonics

ECSE 423 Fundamentals of Photonics
ECSE 430 Photonic Devices and Systems
ECSE 432 Physical Basis: Transistor Devices

Power Engineering

ECSE 404 Control Systems
ECSE 460 Appareillage électrique (Electrical Power Equipment)
ECSE 462 Electromechanical Energy Conversion
ECSE 464 Power System Analysis 1
ECSE 465 Power Electronic Systems
ECSE 468 Electricité industrielle (Industrial Power Systems)

Telecommunications*

ECSE 411 Communications Systems 1
ECSE 414 Introduction to Telecommunication Networks

and any one of the following:

ECSE 412 Discrete Time Signal Processing
ECSE 413 Communications Systems 2
ECSE 423 Fundamentals of Photonics
ECSE 451 EM Transmission and Radiation

Laboratory Complementaries **4**

Two of the following eleven 400-level laboratory courses:

ECSE 426 Microprocessor Systems
ECSE 431 Introduction to VSLI CAD
ECSE 435 Mixed-Signal Test Techniques
ECSE 485 IC Fabrication Laboratory
ECSE 486 Power Laboratory
ECSE 487 Computer Architecture Laboratory
ECSE 488 High Frequency Laboratory
ECSE 490 Digital Signal Processing Laboratory
ECSE 491 Communication Systems Laboratory
ECSE 492 Optical Communications Laboratory
ECSE 493 Control and Robotics Laboratory

General Complementaries **6**

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 3.4 "Complementary Studies" for further information.

TOTAL CREDITS **108**

***Enhanced ITT Specialization in Telecommunications**

The International Institute of Telecommunications (IIT) was established in Montreal as a center 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 progam is open to students in the regular Electrical Engineering program only.

The benefits of the specialization are:

– a guaranteed project lab (ECSE 494) in telecommunications, at IIT or with an IIT company; and
– permission to take ECSE 496 at IIT.

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

ECSE 411 Communications Systems 1
ECSE 414 Introduction to Telecommunication Networks
ECSE 496 Telecommuniations Systems and Services

and any three courses selected from the following list:

ECSE 412 Discrete Time Signal Processing
ECSE 413 Communications Systems 2
ECSE 423 Fundamentals of Photonics
ECSE 451 EM Transmission and Radiation

In addition, students must take ECSE 491 (Communications Systems Lab) and complete ECSE 494 (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.

CURRICULUM FOR THE B.ENG. DEGREE IN COMPUTER ENGINEERING

REQUIRED COURSES		COURSE CREDIT	
Non-Departmental Courses			
MATH 260	Intermediate Calculus	3	
MATH 261	Differential Equations	3	
or MATH 325	Ordinary Differential Equations (3)		
MATH 265	Advanced Calculus	3	
or MATH 248*	Advanced Calculus 1 (3)		
MATH 270	Applied Linear Algebra	3	
or MATH 247*	Linear Algebra (3)		
MATH 363	Discrete Mathematics	3	
MATH 381	Complex Variables and Transforms	3	
CIVE 281	Analytical Mechanics	3	
or PHYS 251	Classical Mechanics 1 (3)		
MIME 221	Engineering Professional Practice	2	
MIME 310	Engineering Economy	3	
COMP 202	Introduction to Computing 1	3	
COMP 250	Introduction to Computer Science	3	
COMP 302	Programming Languages and Paradigms	3	
EDEC 206	Communication in Engineering	3	**38**

** CGPA of 3.30 is required to register for MATH 247 and MATH 248.*

Departmental Courses			
ECSE 200	Fundamentals of Electrical Engineering	3	
ECSE 210	Circuit Analysis	3	
ECSE 221	Introduction to Computer Engineering	3	
ECSE 291	Electrical Measurements Laboratory	2	
ECSE 303	Signals and Systems 1	3	
ECSE 304	Signals and Systems 2	3	
ECSE 305	Probability and Random Sig. 1	3	
ECSE 321	Introduction to Software Engineering	3	
ECSE 322	Computer Engineering	3	
ECSE 323	Digital System Design	5	
ECSE 330	Introduction to Electronics	3	
ECSE 334	Introduction to Microelectronics	5	
ECSE 353	Electromagnetic Fields and Waves	3	
ECSE 425	Computer Organization and Architecture	3	
ECSE 427	Operating Systems	3	
ECSE 494	Electrical Engineering Design Project	3	**51**

COMPLEMENTARY COURSES

Technical Complementaries **9**

Three courses (9 credits) selected from:

ECSE 404 Control Systems
ECSE 411 Communications Systems 1
ECSE 412 Discrete Time Signal Processing
ECSE 414 Introduction to Telecommunication Networks

ECSE 424	Human-Computer Interaction	
ECSE 426	Microprocessor Systems	
ECSE 428	Software Engineering Practice	
ECSE 431	Introduction to VSLI CAD	
ECSE 530	Logic Synthesis	
ECSE 526	Artificial Intelligence	
ECSE 531	Real Time Systems	
ECSE 532	Computer Graphics	
ECSE 548	Introduction to VLSI Systems	
COMP 420	Files and Databases	
COMP 431	Algorithms and Data Structures	
COMP 535	Computer Networks 1	
COMP 575	Fundamentals of Distributed Algorithms	

Laboratory Complementaries **4**

Two of the following nine 400-level laboratory courses:

ECSE 426	Microprocessor Systems
ECSE 431	Introduction to VSLI CAD
ECSE 435	Mixed-Signal Test Techniques
ECSE 486	Power Laboratory
ECSE 487	Computer Architecture Laboratory
ECSE 489	Telecommunication Network Lab
ECSE 490	Digital Signal Processing Laboratory
ECSE 491	Communication Systems Laboratory
ECSE 493	Control and Robotics Laboratory

General Complementaries **6**

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 3.4 "Complementary Studies" for further information.

TOTAL CREDITS **108**

CURRICULUM FOR THE BACHELOR OF SOFTWARE ENGINEERING (B.S.E.)

REQUIRED COURSES		COURSE CREDIT	
COMP 202	Introduction to Computing 1	3	
COMP 206	Introduction to Software Systems	3	
COMP 250	Introduction to Computer Science	3	
COMP 251	Data Structures and Algorithms	3	
COMP 302	Programming Languages and Paradigms	3	
COMP 330	Theoretical Aspects: Computer Science	3	
COMP 360	Algorithm Design Techniques	3	
COMP 361	Systems Development Project	3	
COMP 420	Files and Databases	3	
ECSE 221	Introduction to Computer Engineering	3	
ECSE 321	Introduction to Software Engineering	3	
ECSE 322	Computer Engineering	3	
ECSE 427	Operating Systems	3	
ECSE 428	Software Engineering Practice	3	
ECSE 429	Software Validation	3	
ECSE 495	Software Engineering Design Project	3	
MATH 260	Intermediate Calculus	3	
MATH 261	Differential Equations	3	
MATH 265	Advanced Calculus	3	
MATH 270	Applied Linear Algebra	3	
MATH 363	Discrete Mathematics	3	
MATH 381	Complex Variables and Transforms	3	**66**

Engineering Breadth Required Courses

ECSE 200	Fundamentals of Electrical Engineering	3	
ECSE 210	Circuit Analysis	3	
ECSE 291	Electrical Measurements Laboratory	2	
ECSE 303	Signals and Systems 1	3	
ECSE 305	Probability and Random Sig. 1	3	
ECSE 330	Introduction to Electronics	3	
EDEC 206	Communication in Engineering	3	
MIME 310	Engineering Economy	3	
MIME 221	Engineering Professional Practice	2	**25**

Technical Complementaries **11 - 12**

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

COMP 350	Numerical Computing
COMP 409	Concurrent Programming
COMP 424	Topics: Artificial Intelligence 1
COMP 433	Personal Software Engineering
COMP 524	Theoretical Foundations of Programming Languages
COMP 575	Fundamentals of Distributed Algorithms

Group B Technical Complementaries

ECSE 304	Signals and Systems 2
ECSE 323	Digital Systems Design
ECSE 404	Control Systems
ECSE 411	Communications Systems 1
ECSE 412	Discrete Time Signal Processing
ECSE 413	Communications Systems 2
ECSE 414	Introduction to Telecommunication Networks
ECSE 421	Embedded Systems
ECSE 422	Fault Tolerant Computing
ECSE 420	Parallel Computing
ECSE 424	Human-Computer Interaction
ECSE 425	Computer Organization and Architecture
ECSE 426	Microprocessor Systems
or COMP 573	Microcomputers
ECSE 504	Computer Control
ECSE 522	Asynchronous Circuits and Systems
ECSE 526	Artificial Intelligence
ECSE 529	Image Processing and Communication
ECSE 530	Logic Synthesis
ECSE 531	Real Time Systems
ECSE 532	Computer Graphics
COMP 557	Computer Graphics
COMP 410	Mobile Computing
COMP 412	Software for E-commerce
COMP 505	Advanced Computer Architecture
COMP 520	Compiler Design
COMP 535	Computer Networks 1
COMP 566	Discrete Optimization 1

General Complementaries **6**

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 3.4 "Complementary Studies" for further information.

TOTAL CREDITS **108/109**

4.5 Department of Mechanical Engineering

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Chair — Arun K. Misra

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

Post-Retirement

Glen Bach; B.Sc.(Alta.), M.Sc.(Birm.), Ph.D.(McG.)
Lucjan Kops; B.Eng., M.Eng., D.Sc., Eng. (Krakow Tech.U.), Eng., M.C.I.R.P., F.A.S.M.E., F.C.S.M.E.

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Arun K. Misra; B.Tech.(I.I.T.,Kharagpur), Ph.D.(U.B.C.), P.Eng.
Martin Ostoja-Starzewski; M.Eng., Ph.D.(McG.), F.A.S.M.E. *(Canada Research Chair)*
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Meyer Nahon; B.Sc.(Queen's), M.Sc.(Tor.), Ph.D.(McG.), P.Eng. (Graduate Program Coordinator)
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Mechanical engineers are traditionally concerned with the conception, design, implementation and operation of mechanical systems. Typical fields of work are aerospace, energy, manufacturing, machinery, and transportation. Because of the very broad nature of the discipline there is usually a high demand for mechanical engineers.

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

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

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

The Department offers an Honours Program which is particularly suitable for those with a high aptitude in mathematics and physics and which gives a thorough grounding in the basic engineering 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 extracurricular activities. Students are active in such professional societies as CASI (Canadian Aeronautics and Space Institute), SAE (Society of Automotive Engineers), and ASME (American Society of Mechanical Engineers) and in various campus organizations.

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

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

REQUIRED COURSES		COURSE CREDIT	
Non-Departmental Subjects			
CIVE 207	Solid Mechanics	4	
COMP 208	Computers in Engineering	3	
ECSE 461	Electric Machinery	3	
EDEC 206	Communication in Engineering	3	
MATH 260	Intermediate Calculus	3	
MATH 261	Differential Equations	3	
MATH 265	Advanced Calculus	3	
MATH 266	Linear Algebra and Boundary Value Problems	4	
MIME 221	Engineering Professional Practice	2	
MIME 260	Materials Science and Engineering	3	
MIME 310	Engineering Economy	3	**34**
Departmental Courses			
MECH 201	Introduction to Mechanical Engineering	2	
MECH 210	Mechanics 1	2	
MECH 220	Mechanics 2	4	
MECH 240	Thermodynamics 1	3	
MECH 260	Machine Tool Laboratory	2	
MECH 262	Statistics and Measurement Laboratory	3	
MECH 291	Graphics	3	
MECH 292	Design 1	3	
MECH 314	Dynamics of Mechanisms	3	
MECH 315	Mechanics 3	4	
MECH 321	Mechanics of Deformable Solids	3	
MECH 331	Fluid Mechanics 1	3	
MECH 341	Thermodynamics 2	3	
MECH 346	Heat Transfer	3	
MECH 362	Mechanical Laboratory 1	2	
MECH 383	Applied Electronics and Instrumentation	3	
MECH 393	Design 2	3	
MECH 409	Numerical Methods in Mechanical Engineering	3	
MECH 412	Dynamics of Systems	3	
MECH 430	Fluid Mechanics 2	3	
MECH 463D1	Mechanical Engineering Project	3	
MECH 463D2	Mechanical Engineering Project	3	**64**
COMPLEMENTARY COURSES			**15**
2 courses (6 credits) at the 300 level or higher to be selected from Mechanical Engineering. For students who entered in September 2000 or later, one of these two courses must be chosen from the following list:			
MECH 343	Energy Conversion		

MECH 413	Control Systems
MECH 432	Aircraft Structures
MECH 471	Industrial Engineering
MECH 472	Case Studies in Project Mgmt
MECH 495	Design 3
MECH 496	Design 4
MECH 497	Value Engineering
MECH 524	Computer Integrated Manufacturing
MECH 526	Manufacturing and the Environment
MECH 528	Product Design
MECH 532	Aircraft Performance, Stability and Control
MECH 541	Kinematic Synthesis
MECH 543	Design with Composite Materials
MECH 554	Microprocessors for Mechanical Systems
MECH 557	Mechatronic Design
MECH 565	Fluid Flow and Heat Transfer Equipment
MECH 572	Introduction to Robotics
MECH 573	Mechanics of Robotic Systems
MECH 577	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 3.4 "Complementary Studies" for further information.

TOTAL CREDITS **113**

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 advisor.

Additional information can be found in section 3.1.2 "Basic Science Requirements for Students Entering from Outside Quebec".

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

REQUIRED COURSES		COURSE CREDIT	
Non-Departmental Subjects			
CIVE 207	Solid Mechanics	4	
EDEC 206	Communication in Engineering	3	
COMP 208	Computers in Engineering	3	
MATH 260	Intermediate Calculus	3	
MATH 261	Differential Equations	3	
MATH 265	Advanced Calculus	3	
MATH 266	Linear Algebra and Boundary Value Problems	4	
MIME 221	Engineering Professional Practice	2	
MIME 310	Engineering Economy	3	**28**
Departmental Courses			
MECH 201	Introduction to Mechanical Engineering	2	
MECH 210	Mechanics 1	2	
MECH 220	Mechanics 2	4	
MECH 240	Thermodynamics 1	3	
MECH 260	Machine Tool Laboratory	2	
MECH 262	Statistics and Measurement Laboratory	3	
MECH 291	Graphics	3	
MECH 292	Design 1	3	
MECH 321	Mechanics of Deformable Solids	3	
MECH 331	Fluid Mechanics 1	3	
MECH 341	Thermodynamics 2	3	
MECH 346	Heat Transfer	3	
MECH 362	Mechanical Laboratory 1	2	
MECH 383	Applied Electronics and Instrumentation	3	
MECH 403D1	Thesis (Honours)	3	
MECH 403D2	Thesis (Honours)	3	
MECH 404	Honours Thesis 2	3	
MECH 409	Numerical Methods in Mechanical Engineering	3	
MECH 419	Advanced Mechanics of Systems	3	
MECH 430	Fluid Mechanics 2	3	
MECH 452	Mathematical Methods in Engineering 1	3	
MECH 494	Honours Design Project	3	**63**
COMPLEMENTARY COURSES			**21**

2 of the following three courses (6 credits):

MECH 545	Advanced Stress Analysis
MECH 562	Advanced Fluid Mechanics
MECH 578	Advanced Thermodynamics

2 courses (6 credits) at the 300 level or higher to be selected from Mechanical Engineering. For students who entered in September 2000 or later, one of these two courses must be chosen from the following list:

MECH 343	Energy Conversion
MECH 413	Control Systems
MECH 432	Aircraft Structures
MECH 471	Industrial Engineering
MECH 472	Case Studies in Project Mgmt
MECH 495	Design 3
MECH 496	Design 4
MECH 497	Value Engineering
MECH 524	Computer Integrated Manufacturing
MECH 526	Manufacturing and the Environment
MECH 528	Product Design
MECH 532	Aircraft Performance, Stability and Control
MECH 541	Kinematic Synthesis
MECH 543	Design with Composite Materials
MECH 554	Microprocessors for Mechanical Systems
MECH 557	Mechatronic Design
MECH 565	Fluid Flow and Heat Transfer Equipment
MECH 572	Introduction to Robotics
MECH 573	Mechanics of Robotic Systems
MECH 577	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 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 advisor.

Additional information can be found in section 3.1.2 "Basic Science Requirements for Students Entering from Outside Quebec".

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

MECH 343	Energy Conversion
MECH 413	Control Systems
MECH 432	Aircraft Structures
MECH 434	Turbomachinery
MECH 447	Combustion
MECH 471	Industrial Engineering
MECH 472	Case Studies in Project Mgmt
MECH 474	Selected Topics in Operations Research
MECH 495	Design 3
MECH 496	Design 4
MECH 497	Value Engineering
MECH 500	Selected Topics in Mechanical Engineering
MECH 501	Special Topics: Mechanical Engineering
MECH 522	Production Systems
MECH 524	Computer Integrated Manufacturing
MECH 526	Manufacturing and the Environment
MECH 528	Product Design
MECH 529	Discrete Manufacturing Systems

MECH 530 Mechanics of Composite Materials
MECH 531 Aeroelasticity
MECH 532 Aircraft Performance, Stability and Control
MECH 533 Subsonic Aerodynamics
MECH 534 Air Pollution Engineering
MECH 537 High-Speed Aerodynamics
MECH 538 Unsteady Aerodynamics
MECH 539 Computational Aerodynamics
MECH 540 Design: Modelling and Decision
MECH 541 Kinematic Synthesis
MECH 542 Spacecraft Dynamics
MECH 543 Design with Composite Materials
MECH 545 Advanced Stress Analysis
MECH 552 Advanced Applied Mathematics
MECH 554 Microprocessors for Mechanical Systems
MECH 555 Applied Process Control
MECH 557 Mechatronic Design
MECH 561 Biomechanics of Musculoskeletal Systems
MECH 562 Advanced Fluid Mechanics
MECH 565 Fluid Flow and Heat Transfer Equipment
MECH 572 Introduction to Robotics
MECH 573 Mechanics of Robotic Systems
MECH 576 Computer Graphics and Geometrical Modelling
MECH 577 Optimum Design
MECH 578 Advanced Thermodynamics
MECH 581 Nonlinear Dynamics and Chaos

TYPICAL PROGRAM OF STUDIES FOR REGULAR OR HONOURS

For students starting their B.Eng. studies in September 2003 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)
COMP 208 Computers in Engineering
MATH 260 Intermediate Calculus
MECH 201 Introduction to Mechanical Engineering
MECH 210 Mechanics 1
MECH 260 Machine Tool Laboratory
MIME 221 Engineering Professional Practice
Term 2 (Winter)
EDEC 206 Communication in Engineering
MATH 261 Differential Equations
MATH 265 Advanced Calculus
MECH 220 Mechanics 2
MECH 262 Statistics and Measurement Laboratory
MECH 291 Graphics

STREAM B:
Term 1 (Fall)
COMP 208 Computers in Engineering
MATH 260 Intermediate Calculus
MECH 201 Introduction to Mechanical Engineering
MECH 260 Machine Tool Laboratory
MECH 291 Graphics
MIME 221 Engineering Professional Practice

Term 2 (Winter)
MATH 261 Differential Equations
MATH 265 Advanced Calculus
MECH 210 Mechanics 1
MECH 262 Statistics and Measurement Laboratory
MIME 260 Materials Science and Engineering

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. Specifically they must take the following two required courses:

MECH 532 Aircraft Performance, Stability and Control
MECH 533 Subsonic Aerodynamics

and at least one of the following:
MECH 432 Aircraft Structures
MECH 434 Turbomachinery

The remaining two courses may be chosen from the above or from the following courses:
MECH 531 Aeroelasticity
MECH 537 High-Speed Aerodynamics
MECH 538 Unsteady Aerodynamics
MECH 539 Computational Aerodynamics

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

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

DESIGN CONCENTRATION

The Design Concentration is comprised of six courses as follows:
MECH 495 Design 3
MECH 496 Design 4

Plus any four below:
MECH 497 Value Engineering
MECH 540 Design: Modelling and Decision
MECH 541 Kinematic Synthesis
MECH 543 Design with Composite Materials
MECH 557 Mechatronic Design
MECH 565 Fluid Flow and Heat Transfer Equipment
MECH 576 Computer Graphics and Geometrical Modelling
MECH 577 Optimum Design

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:

MECH 413 Control Systems
MECH 554 Microprocessors for Mechanical Systems
MECH 557 Mechatronic Design
MECH 572 Introduction to Robotics

and two of the following:
MECH 528 Product Design
MECH 541 Kinematic Synthesis
MECH 573 Mechanics of Robotic Systems
MECH 576 Computer Graphics and Geometrical Modelling
ECSE 502 Control Engineering

4.6 Department of Mining, Metals and Materials Engineering

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Chair — Robin A.L. Drew

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

Professors
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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.Ing., Ph.D.(Montr.), Eng.
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Jerzy Szpunar; B.Sc., M.Sc., Ph.D., D.Sc.(Krakow)

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Ralph Harris; B.Sc.(Qld), M.Eng., Ph.D.(McG.)
Mainul Hasan; B.Eng.(Dhaka), M.Sc.(Dhahran), Ph.D.(McG.)
Janusz A. Kozinski; B.A., M.Eng., D.Sc.(Krakow)*(William Dawson Scholar)*
André Laplante; B.A.Sc., M.A.Sc.(Montr.), Ph.D.(Tor.), Eng.
Frank Mucciardi; B.Eng., M.Eng., Ph.D.(McG.), Eng.
Jacques Ouellet; B.A.Sc.(Laval), M.A.Sc, Ph.D.(Montr.), Eng.
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CO-OP Programs
Director — Frank Mucciardi
Work-term Coordinators —
Genevieve Snider (Materials)
Michel Vachon (Mining)

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

The equipment operated by the Department is the best available. On the materials side there is a full range of laboratory facilities for extractive and process metallurgy as well as excellent materials characterization and processing facilities. In mining engineering the Department has rock engineering laboratories to test the mechanical properties of both rock and backfill materials and computer-aided mine design facilities.

Metals and Materials Engineering (CO-OP). The Metals and Materials Engineering degree is a cooperative program leading to a B.Eng. and includes 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 metals/materials engineering. Students take core courses covering processing, fabrication, applications and performance. The program conforms with requirements of the Canadian Engineering Accreditation Board (CEAB) and is designed to offer students the best training for employment in Canada's large and vital metallurgical and manufacturing industries. The basic courses are supplemented by complementary courses which provide a good choice 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 mineral/metal producing and processing sectors, as well as the aerospace and manufacturing industries. 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.

Mining Engineering (CO-OP). McGill, which has the oldest mining engineering program in Canada, has always been noted for the excellence of its courses and for the training it provides in mining technology, mineral economics and mining practice. Graduates in mining engineering are in demand not only in Canada but throughout the world. Technical developments have been rapid in recent years. These offer a challenge to the imaginative student with a strong engineering interest. The Department offers a cooperative program leading to the B.Eng. degree in Mining Engineering. The CO-OP program is offered in collaboration with the Département des génies civil, géologique et des mines at École Polytechnique in Montreal, and includes formal industrial work periods. Students registered at McGill are required to take a series of technical mining courses at École Polytechnique in the latter part of the program. These courses are designated as such in the program outline (Subject Code MPMC).

Scholarships
The Department offers Entrance Scholarships each year, valued at $3000; these scholarships are renewable. A substantial number of other scholarships and bursaries are awarded by the Department as well as by the Canadian Mineral Industry Education Foundation.

Student Advising
Students entering the Mining or Metals and Materials Engineering programs must plan their schedule of studies in consultation with one of the departmental advisors: Professors Laplante and Yue (Materials) or Mr. J. Mossop (Mining).

CURRICULUM FOR THE B.ENG. DEGREE IN METALS AND MATERIALS ENGINEERING – CO-OP PROGRAM

REQUIRED COURSES		COURSE CREDITS	
Non-Departmental Courses			
CHEM 233	Topics in Physical Chemistry	3	
CIVE 205	Statics	3	
CIVE 207	Solid Mechanics	4	
COMP 208	Computers in Engineering	3	
MATH 260	Intermediate Calculus	3	
MATH 261	Differential Equations	3	
MATH 265	Advanced Calculus	3	**22**
Departmental Courses			
MIME 200	Introduction to the Minerals Industry	3	
MIME 202	Engineering Communication Skills	2	
MIME 209	Mathematical Applications	3	
MIME 212	Engineering Thermodynamics	3	
MIME 221	Engineering Professional Practice	2	
MIME 261	Structure of Materials	3	
MIME 280	Industrial Training 1	2	
MIME 310	Engineering Economy	3	
MIME 311	Modelling and Automatic Control	3	
MIME 317	Analytical and Characterization Techniques	3	
MIME 337	Electrotechnology	2	
MIME 341	Introduction to Mineral Processing	3	
MIME 350	Extractive Metallurgical Engineering	3	
MIME 352	Hydrochemical Processing	3	
MIME 356	Heat, Mass and Fluid Flow	4	
MIME 360	Phase Transformations: Solids	3	
MIME 362	Mechanical Properties	3	
MIME 367	Electronic Properties of Materials	3	
MIME 380	Industrial Training 2	2	
MIME 442	Modelling and Control: Mineral Processing	3	
MIME 452	Process and Materials Design	4	
MIME 455	Advanced Process Engineering	3	
MIME 456	Steelmaking and Steel Processing	3	
MIME 465	Ceramic Engineering	3	

MIME 480	Industrial Training 3	2	
MIME 481	Industrial Training 4	2	
CHEM 455	Introductory Polymer Chemistry	3	**76**

COMPLEMENTARY COURSES

Technical Courses **12**

Four courses may be taken; one of these can be chosen from the Faculty list. (Note: Not all courses are given annually; verification with course instructor is advised.)

CHEE 481	(3)	Polymer Engineering
CHEE 581	(3)	Polymer Composites Engineering
CHEM 585	(3)	Colloid Chemistry
CIVE 512	(3)	Advanced Civil Engineering Materials
MECH 530	(3)	Mechanics of Composite Materials
MIME 361	(3)	Liquid State Processing of Materials
MIME 410	(3)	Research Project
MIME 412	(3)	Corrosion and Degradation
MIME 451	(3)	Environmental Controls: Met'l Plants
MIME 457	(3)	Light Metals Extraction and Processing
MIME 463	(3)	Deformation Processing of Metals
MIME 515	(3)	Advanced Metallurgical and Materials Thermodynamics
MIME 544	(3)	Analysis: Mineral Processing Systems 1
MIME 545	(3)	Analysis: Mineral Processing Systems 2
MIME 551	(3)	Electrochemical Processing
MIME 555	(3)	Thermal Remediation of Wastes
MIME 560	(3)	Joining Processes
MIME 563	(3)	Hot Deformation of Metals
MIME 564	(3)	X-ray Diffraction Analysis of Materials
MIME 566	(3)	Texture, Structure & Properties of Polycrystalline Materials
MIME 567	(3)	Aluminum Casting Alloys
MIME 568	(3)	Topics in Advanced Materials
MIME 569	(3)	Electron Beam Analysis of Materials
PHYS 558	(3)	Solid State Physics

General Complementaries **6**

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 3.4 "Complementary Studies" for further information.

TOTAL **116**

A fee of $500 is assessed by the University for each Industrial Training course.

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

REQUIRED COURSES		**COURSE CREDITS**	
Non-Departmental Courses			
CIVE 205	Statics	3	
CIVE 207	Solid Mechanics	4	
COMP 208	Computers in Engineering	3	
EPSC 221	General Geology	3	
EPSC 225	Properties of Minerals	1	
MATH 260	Intermediate Calculus	3	
MATH 261	Differential Equations	3	
MATH 265	Advanced Calculus	3	
MECH 290	Graphics 2	3	**26**
Departmental Mining Courses			
MIME 200	Introduction to the Minerals Industry	3	
MIME 202	Engineering Communication Skills	2	
MIME 203	Mine Surveying (2 weeks at beginning of summer)	2	
MIME 209	Mathematical Applications	3	
MIME 221	Engineering Professional Practice	2	
MIME 260	Materials Science and Engineering	3	
MIME 290	Industrial Work Period 1	2	
MIME 291	Industrial Work Period 2	2	
MIME 310	Engineering Economy	3	
MIME 322	Rock Fragmentation	3	
MIME 323	Rock and Soil Mass Characterization	3	
MIME 325	Mineral Industry Economics	3	
MIME 333	Materials Handling	3	
MIME 337	Electrotechnology	2	
MIME 340	Applied Fluid Dynamics	3	
MIME 341	Introduction to Mineral Processing	3	
MIME 392	Industrial Work Period 3	2	
MIME 419	Surface Mining	3	
MIME 420	Feasibility Study	3	
MIME 426	Development and Services	3	
MIME 484	Mining Project	3	**56**
École Polytechnique Mining Courses			
MPMC 320	CAO et informatique pour les mines	3	
MPMC 321	Mécanique des roches et contrôle des terrains	3	
MPMC 326	Recherche opérationnelle I	3	
MPMC 328	Environnement et gestion des rejets miniers	3	
MPMC 329	Géologie minière	2	
MPMC 330	Géotechnique minière	3	
MPMC 421	Exploitation en souterrain	3	
MPMC 422	Ventilation minière et hygiène du travail	3	**23**

COMPLEMENTARY COURSES

Either Choice I or II **8 or 9**

Choice I (8 credits)

MIME 494	(2)	Industrial Work Period 4
and		two Technical Complementaries

or Choice II (9 credits)

MIME 350	(3)	Extractive Metallurgical Engineering
MIME 544	(3)	Analysis: Mineral Processing Systems 1
and		one Technical Complementary

General Complementaries **6**

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 3.4 "Complementary Studies" for further information.

TOTAL **119/120**

Mining Technical Complementary Course List:

MIME 320	(3)	Extraction of Energy Resources
MIME 442	(3)	Modelling and Control: Mineral Processing
MIME 520	(3)	Stability of Rock Slopes
MIME 521	(3)	Stability of Underground Openings
MIME 526	(3)	Mineral Economics
MIME 528	(3)	Mining Automation
MIME 544	(3)	Analysis: Mineral Processing Systems 1
MIME 545	(3)	Analysis: Mineral Processing Systems 2
MPMC 327	(3)	Hydrogéologie appliquée
MPMC 424	(2)	Gérance d'exploitation minière
MPMC 525	(3)	Recherce opérationnelle minière II

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

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
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)
Raphaël Fischler; B.Eng.(Eindhoven), M.Sc., M.C.P.(MIT), Ph.D.(U.C. Berk.)

Assistant Professors
Madhav G. Badami; B.Tech., M.S.(I.I.T., Madras) M.E.Des.(Calg.), Ph.D.(Br.Col.) *(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. *(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., Master of City Planning(Harvard)
Mario Polèse; B.A.(CUNY), M.A., Ph.D.(Penn.)

Guest Lecturers
Cameron Charlebois, Luc Danielse, Marc Denhez, Andrew Hoffmann, Peter Jacobs, Brenda Lee, Léon Ploegaerts, Alain Trudeau, Ray Tomalty, Martin Wexler

Modern urban planning developed into a profession in the early decades of the twentieth 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 nineteenth 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 inter-disciplinary 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 traffic management, 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 and the private sectors. Training is provided at the post-graduate 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 their internship 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:

ARCH 550 Urban Planning 1
ARCH 551 Urban Planning 2
URBP 501 Principles and Practice 1
URBP 505 Geographic Information Systems
URBP 506 Environmental Policy and Planning

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 course choices, 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 advisors.

Some general information applicable to all students of the Faculty is given below. This mainly covers the areas of materials engineering, management, biotechnology, economics, mathematics, arts, environmental engineering, computer science and chemistry. Further information is available through the Faculty of Engineering Student Affairs Office, Macdonald Engineering Building, Rm 378.

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 3.4 "Complementary Studies"), may be used to satisfy some of these requirements. In no case will more than 9 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 Advisor, 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.

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 advisor 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 advisor, 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 398-3998. A full description of the Minor program appears under the Faculty of Science, "Biotechnology (BIOT)" on page 265.

A Chemical Engineering student may complete the Biotechnology Minor by taking BIOL 200, BIOL 201, BIOL 202, MIMM 211, BIOT 505, plus one course from the list of additional courses not including MIME 310. The Department of Chemical Engineering permits students in the Minor program to complete BIOT 505 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.

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: CHEM 212, CHEM 233 and CHEM 234 (or CEGEP equivalent)
2. At least 15 credits from the following list, two of which must be laboratory courses (* indicates lab). Note that CHEM 212 is a prerequisite for most of the courses listed below. If students take CHEM 222* instead of CHEM 234, 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

CHEM 281 Inorganic Chemistry 1
CHEM 371 Inorganic Chemistry Laboratory*
CHEM 381 Chemistry of Transition Elements
CHEM 591 Advanced Coordination Chemistry

Analytical Chemistry

CHEM 257D1 Introductory Analytical Chemistry*
CHEM 257D2 Introductory Analytical Chemistry*
or CHEM 277D1 Analytical Chemistry*
CHEM 277D2 Analytical Chemistry*

CHEM 307 Analytical Chemisty of Pollutants
CHEM 367 Instrumental Analysis 1
CHEM 377 Instrumental Analysis 2

Organic Chemistry

CHEM 302 Introductory Organic Chemistry 3
CHEM 352 Structural Organic Chemistry
CHEM 362 Advanced Organic Chemistry Laboratory*
CHEM 382 Organic Chemistry: Natural Products
CHEM 402 Advanced Bio-organic Chemistry

Physical Chemistry

CHEM 345 Molecular Properties and Structure 1
CHEM 355 Molecular Properties and Structure 2
CHEM 363 Physical Chemistry Laboratory 1*
CHEM 393 Physical Chemistry Laboratory 2*
CHEM 455 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.

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 (COMP 208) 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.

COMP 202 Introduction to Computing 1
COMP 208 Computers in Engineering
COMP 250 Introduction to Computer Science
COMP 302 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, 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 complementaries, and credits that can be double counted.

Students should see the receptionist in 318 McConnell to obtain the appropriate forms and to make an appointment to see the Minor Advisor 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

[Program revisions are under consideration for September 2003. Go to www.mcgill.ca (Course Calendars) in July for details.]

The program must consist of 24 credits, from courses passed with a grade of C or better, as follows:

Required Course (3 credits)

COMP 302 (3) Programming Languages and Paradigms

Complementary Courses (21 credits)

3 credits – one of the following courses:
COMP 203 (3) Introduction to Computing 2
COMP 250 (3) Introduction to Computer Science
COMP 251 (3) Data Structures and Algorithms

3 credits – one of the following courses:
COMP 206 (3) Introduction to Software Systems
ECSE 221 (3) Introduction to Computer Engineering

3 credits – one of the following courses:
COMP 273 (3) Introduction to Computer Systems
ECSE 222 (3) Introduction to Computer Engineering 2

3 credits – one of the following courses:
COMP 350 (3) Numerical Computing
MECH 409 (3) Numerical Methods in Mechanical Engineering

9 credits chosen from Computer Science courses numbered 300 or higher, or any course making considerable use of computing and approved by the School of Computer Science for the Minor.*

* Students may consult with the School of Computer Science about the acceptabiity of particular courses. The courses in other departments are at a variety of levels. Some may be required courses in the student's Engineering program; some are courses that may be taken as technical complementaries. Students should consult with their advisors about the possibility of taking specific courses.

Note:

A. COMP 202 and COMP 208 (compulsory for some Engineering students) do not form part of the Minor.

B. COMP 202 is a prerequisite for COMP 203. Students with a substantial high level language programming course may forego this prerequisite. Some additional make-up effort may be needed at the start of the course.

C. COMP 208 cannot be taken for credit with or after COMP 250.

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 484, Macdonald Engineering Building.

Prerequisites:

CIVE 208 Civil Engineering Systems Analysis or an equivalent course in Operations Research
CIVE 302 Probabilistic Systems or equivalent
COMP 208 Computers in Engineering or equivalent
MIME 310 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:

FACC 220 (3) Law for Architects and Engineers
INDR 294 (3) Introduction to Labour-Management Relations
MGCR 211 (3) Introduction to Financial Accounting
MGCR 341 (3) Finance 1

and one of:
CIVE 324 (3) Construction Project Management
MECH 472 (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:
ARCH 446 (2) Mechanical Services in Buildings
ARCH 447 (2) Electrical Services
ARCH 451 (2) Building Regulations and Safety
CIVE 492 (2) Structures

or

b) 3 credits - One of the following relating to Heavy Construction:
MIME 322 (3) Rock Fragmentation
MIME 333 (3) Materials Handling

3. Other Construction-Related Complementaries: 6 credits
Any two of the following:
ABEN 411 (3) Off-Road Power Machinery
BUSA 462 (3) Management of New Enterprises
CIVE 446 (3) Construction Engineering
CIVE 527 (3 Renovation and Preservation: Infrastructure
CIVE 586 (3) Earthwork Engineering
ECSE 461 (3) Electric Machinery
FINE 445 (3) Real Estate Finance
MIME 520 (3) Stability of Rock Slopes
MIME 521 (3 Stability of Underground Openings
MPMC 321 (3) Mécanique des roches et contrôle des terrains

Total requirement: 24 or 25 credits

5.6 Economics Minor

The Minor consists of 18 credits in courses given in the Economics Department. It consists of required courses and complementaries. In addition, it is presumed that all Engineering students will have a sufficient background in statistics. Engineering Economy, MIME 310, does not form part of this minor. For more information see the Department of Economics, Leacock Room 443.

Required Courses (9 credits)
ECON 230D1* Microeconomic Theory
ECON 230D2* Microeconomic Theory
ECON 209** Macroeconomic Analysis and Applications

Complementary Courses (9 credits) from:
ECON 225 Economics of the Environment
ECON 302D1 Money and Banking
ECON 302D2 Money and Banking
ECON 303D1 Canadian Economic Policy
ECON 303D2 Canadian Economic Policy
ECON 305 Industrial Organization
ECON 306D1 Labour Economics and Institutions
ECON 306D2 Labour Economics and Institutions
ECON 308 Public Policies Toward Business
ECON 311 United States Economic Development
ECON 313 Economic Development 1
ECON 314 Economic Development 2
ECON 316 The Underground Economy
ECON 321 The Quebec Economy
ECON 326 Ecological Economics
ECON 329 Economics of Confederation
ECON 330D1 Macroeconomic Theory
ECON 330D2 Macroeconomic Theory
ECON 331 Economic Development: Russia and USSR
ECON 332 Comparative Economic Systems
ECON 333 Comparative Economic Systems
ECON 335 The Japanese Economy
ECON 337 Introductory Econometrics 1
ECON 344 The International Economy, 1830 - 1914
ECON 345 The International Economy Since 1914
ECON 347 Economics of Climate Change
ECON 404 Transportation
ECON 405 Natural Resource Economics
ECON 406 Topics in Economic Policy
ECON 408D1 Public Sector Economics
ECON 408D2 Public Sector Economics
ECON 411 Economic Development: A World Area
ECON 416 Topics in Economic Development 2
ECON 420 Topics in Economic Theory
ECON 423D1 International Trade and Finance
ECON 423D2 International Trade and Finance
ECON 426 Labour Economics
ECON 434 Current Economic Problems
ECON 440 Health Economics
ECON 447 Economics of Information and Uncertainty
ECON 467D1 Econometrics - Honours
ECON 467D2 Econometrics - Honours
ECON 525 Project Analysis
ECON 534 Pensions Crisis
ECON 546 Game Theory

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

* Students may, with consent of instructor, take ECON 250D1/ECON 250D2 Introduction to Economic Theory: Honours, in place of ECON 230D1/ECON 230D2.

** This requirement is waived for students who choose ECON 330D1/ECON 330D2 from the list of complementaries. Students may **not** take both ECON 209 and ECON 330D1/ ECON 330D2.

5.7 Environmental Engineering Minor

The Environmental Engineering Minor is offered for students of Engineering and the Department of Agricultural and Biosystems Engineering wishing to pursue studies in this area. The Minor program consists of 27 credits in courses. Through a judicious choice of core and complementary courses listed below, students may minimize the number of additional credits required to obtain this Minor. The Minor typically requires a minimum of 9 to 15 additional credits. This minimum depends on the department/school in which the student is registered.

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.

General Regulations

To complete the Minor in Environmental Engineering, students must:

a) complete a minimum of 21 credits of Engineering courses (a minimum of 6 credits in this category must be chosen outside the student's principal departmental program) (see section A below);

b) complete a minimum of 6 credits of non-Engineering courses (each course must be chosen from a different department, and neither from the student's home department) (see section B below);

c) complete one of the corequisite courses listed below in addition to the 27 credits counted toward the Minor;

d) in the case of Agricultural and Biosystems, Chemical, and Civil Engineering students, courses taken towards the Humanities and Impact course requirements for the Major cannot double-count as Minor program courses;

e) obtain a grade of C or better in all approved courses in the Minor; and

f) satisfy the requirements of both the Minor and the student's departmental program.

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

Corequisites

(Not credited to the Minor Program)

CHEE 230 Environmental Aspects of Technology
or CIVE 225 Environmental Engineering
or MIME 308 Social Impact of Technology
or equivalent environmental impact course

A. ENGINEERING COURSES (21 credits)

Agricultural Engineering (Macdonald Campus)

ABEN 217 Hydrology and Drainage (not open to students who have passed CIVE 323)
ABEN 322 Food Production/Processing Waste Management
ABEN 416 Engineering for Land Development
ABEN 518 Pollution Control for Agriculture

Chemical Engineering

CHEE 351 Separation Processes
CHEE 370 Elements of Biotechnology
CHEE 430 Technology Impact Assessment (not open to students who have passed WILD 437)
CHEE 452 Particulate Systems (offered in alternate years)
CHEE 471 Industrial Water Pollution Control (not open to students who have passed CIVE 430)
CHEE 472 Industrial Air Pollution Control
CHEE 591 Environmental Bioremediation

Civil Engineering and Applied Mechanics

CIVE 225 Environmental Engineering (not part of the Minor for Civil Engineering Students)
CIVE 323 Hydrology and Water Resources (not open to students who have passed ABEN 217)
CIVE 421 Municipal Systems
CIVE 430 Water Treatment and Pollution Control (not open to students who have passed CHEE 471)
CIVE 451 Geoenvironmental Engineering
CIVE 526 Solid Waste Management
CIVE 550 Water Resources Management
CIVE 553 Stream Pollution and Control
CIVE 572 Advanced Hydraulics
CIVE 574 Fluid Mechanics of Water Pollution
CIVE 575 Fluid Mechanics of Air Pollution
CIVE 577 River Engineering
CIVE 585 Groundwater Hydrology

Mechanical Engineering

MECH 343 Energy Conversion
MECH 434 Turbomachinery
MECH 447 Combustion
MECH 525 Intro. to Nuclear Engineering
MECH 526 Manufacturing and the Environment
MECH 534 Air Pollution Engineering

Mining, Metals and Materials Engineering

MIME 412 Corrosion and Degradation
MIME 451 Environmental Controls: Met'l Plants
MIME 555 Thermal Remediation of Wastes
MPMC 327 Hydrogéologie appliquée
MPMC 328 Environnement et gestion des rejets miniers
MPMC 422 Ventilation minière et hygiène du travail

B. NON-ENGINEERING COURSES (6 credits)

Agricultural Sciences (Macdonald Campus)

AEBI 200 Biology of Organisms
AEBI 201 Biology of Organisms 2
AEBI 205 Principles of Ecology
AEPH 510 Agricultural Micrometeorology
ENTO 380 Food Systems and the Environment
MICR 230 Microbial World (not open to students who have passed CHEE 370)
MICR 331 Microbial Ecology (not open to students who have passed CHEE 370)
MICR 341 Mechanisms of Pathogenicity
SOIL 210 Principles of Soil Science (not part of the Minor for Agricultural Engineering Students)
SOIL 331 Soil Physics
WILD 333 Physical and Biological Aspects of Pollution
WILD 375 Issues: Environmental Sciences
WILD 415 Conservation Law
WILD 437 Assessing Environmental Impact (not open to students who have passed CHEE 430)
WOOD 420 Environmental Issues: Forestry
ZOOL 315 Science of Inland Waters

Anthropology

ANTH 206 Environment and Culture

Atmospheric and Oceanic Sciences

ATOC 210 Introduction to Atmospheric Science (not open to students who have passed GEOG 321)
ATOC 220 Introduction to Oceanic Sciences

Biology

BIOL 205 Biology of Organisms
BIOL 208 Introduction to Ecology
BIOL 432 Limnology
BIOL 470 Lake Management

Chemistry

CHEM 307 Analytical Chemisty of Pollutants

Earth and Planetary Sciences
EPSC 243 Environmental Geology (not open to students who have passed or who will take EPSC 221)
EPSC 549 Groundwater Hydrology
Economics
ECON 225 Economics of the Environment
ECON 326 Ecological Economics
ECON 347 Economics of Climate Change
Geography
GEOG 200 Geographical Perspectives: World Environmental Problems
GEOG 201 Introductory Geo-Information Science
GEOG 203 Environmental Systems
GEOG 205 Global Change: Past, Present and Future
GEOG 302 Environmental Management 1
GEOG 308 Principles of Remote Sensing
GEOG 321 Climatic Environments (not open to students who have passed ATOC 210)
GEOG 404 Environmental Management 2
Law
CMPL 580 Environment and the Law
Microbiology and Immunology
MIMM 211 Introductory Microbiology
Religious Studies (Macdonald Campus)
RELG 270 Religious Ethics and the Environment
Sociology
SOCI 328 Environmental Sociology

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 Advisor and the MSE Advisor. For program details, see "Minor in Environment" on page 329.

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 MIME 310 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 MIME 310.

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 MGCR 211, a course in statistics, and a course in micro-economics are prerequisite for MGCR 341. If included in the Minor in Management, MGCR 423 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)
MGCR 211 Introduction to Financial Accounting
MGCR 320 Managing Human Resources

Complementary Courses (9 credits)
3 credits, one of List A:
MGCR 213 Introduction to Management Accounting
MGCR 341 Finance 1
MGCR 373 Operations Research 1
MGCR 382 International Business

3 credits, one of List B:
BUSA 462 Management of New Enterprises
or BUSA 465 Technological Entrepreneurship
MGCR 222 Introduction to Organizational Behaviour
MGCR 352 Marketing Management 1
or MRKT 360 Marketing of Technology
MGCR 360 Social Context of Business
MGCR 423 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 MGCR 373. There are three courses in Engineering that qualify: CIVE 208, MECH 474 and MPMC 326. It should be noted that MGCR 373 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 advisor or the Faculty of Engineering Student Affairs Office.

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)
MIME 260 Materials Science and Engineering
or CHEE 380 Materials Science
MIME 367 Electronic Properties of Materials
MIME 465 Ceramic Engineering
CHEE 481 Polymer Engineering
CHEE 484 Materials Engineering

Complementary Courses (9 credits)
Three courses to be chosen from the following list:
CHEE 381 Polymer Technology
CHEE 483 Industrial Rheology
CHEE 487 Chemical Processing Electronics Industry
CHEE 530 Structure and Properties of Paper
CHEE 581 Polymer Composites Engineering
CHEM 455 Introductory Polymer Chemistry
ECSE 545 Microelectronics Technology
MECH 530 Mechanics of Composite Materials
MIME 360 Phase Transformations: Solids
MIME 361 Liquid State Processing of Materials
MIME 362 Mechanical Properties
MIME 412 Corrosion and Degradation
MIME 560 Joining Processes
MIME 561 Advanced Materials Design
MIME 563 Hot Deformation of Metals
MIME 564 X-Ray Diffraction Analysis of Materials

MIME 566 Texture, Structure & Properties of Polycrystalline Materials
MIME 569 Electron Beam Analysis of Materials

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 MATH 247 (or MATH 223), MATH 260 (or MATH 222), MATH 261 (or MATH 315 or MATH 325), MATH 265 (or MATH 248 or MATH 314), MATH 266, MATH 270, MATH 319.

At least 18 credits must be chosen from the Mathematics and Statistics courses approved for the Mathematics Majors or Honours program, or from MATH 249, MATH 363, MATH 381, MATH 386. The remaining credits may be chosen from mathematically-allied courses.

In addition to an Engineering Advisor, each student in the Minor program must have an Advisor 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 Advisor. Please consult the Department of Mathematics and Statistics for an Advisor.

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:

PHYS 253 Thermal Physics
PHYS 357 Quantum Physics
PHYS 457 Quantum Physics

and at least 9 credits chosen from the following:
PHYS 332 Physics of Fluids
PHYS 362 Statistical Mechanics
PHYS 451 Classical Mechanics
PHYS 514 General Relativity
PHYS 551 Quantum Theory
PHYS 557 Nuclear Physics
PHYS 558 Solid State Physics
PHYS 559 Advanced Statistical Mechanics
PHYS 562 Electromagnetic Theory
PHYS 567 Particle Physics

Students who take PHYS 357 and PHYS 457 can omit PHYS 271 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.

5.13 Technological Entrepreneurship Minor

Engineering students may obtain a Minor in Technological Entrepreneurship by completing 6 courses (18 credits) as listed below. Up to two courses (6 credits) may be double-counted for credit towards the Humanities and Social Sciences Complementary Courses.

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

Students considering the Minor should consult Ms. Judy Pharo, Faculty of Engineering Student Affairs Office, e-mail: judy.pharo @mcgill.ca.

Required Courses (18 credits)
BUSA 465 (3) Technological Entrepreneurship
FACC 480 (3) Technological Entrepreneurship Project
MGCR 320 (3) Managing Human Resources
MGPO 562 (3) Seminar in Organizational Strategy
MRKT 360 (3) Marketing of Technology
ORGB 321 (3) Leadership

5.14 Software Engineering Minor

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

The Minor consists of 24 credits (8 courses). Up to four of the courses (12 credits) may be double-counted for credit towards the B. Eng. degree in Electrical Engineering or Computer Engineering. Students in other programs may double-count up to three courses (9 credits).

Students considering this Minor should contact Ms. Judy Pharo, Faculty of Engineering Student Affairs Office, e-mail: judy.pharo @mcgill.ca.

Required Courses (9 credits)
ECSE 221 (3) Introduction to Computer Engineering
ECSE 321 (3) Introduction to Software Engineering
ECSE 428 (3) Software Engineering Practice

Complementary Courses (15 credits)
one course (3 credits), either:
COMP 203 (3) Introduction to Computing 2
or COMP 250 (3) Introduction to Computer Science

At least one course (3 credits) must be selected from the following list of engineering courses:
CHEE 458 (3) Computer Applications
CHEE 571 (3) Small Computer Applications: Chemical Engineering
CIVE 460 (3) Matrix Structural Analysis
CIVE 550 (3) Water Resources Management
CIVE 572 (3) Computational Hydraulics
ECSE 322 (3) Computer Engineering
ECSE 424 (3) Human-Computer Interaction
ECSE 427 (3) Operating Systems
ECSE 526 (3) Artificial Intelligence
ECSE 531 (3) Real Time Systems
ECSE 532 (3) Computer Graphics
MECH 474 (3) Selected Topics in Operations Research
MECH 524 (3) Computer Integrated Manufacturing
MECH 539 (3) Computational Aerodynamics
MECH 545 (3) Advanced Stress Analysis
MECH 576 (3) Computer Graphics and Geometrical Modelling

No more than two courses (6 credits) can be selected from the following list of courses offered by the School of Computer Science:
COMP 302 (3) Programming Languages and Paradigms
COMP 335 (3) Software Engineering Methods
COMP 420 (3) Files and Databases
COMP 421 (3) Database Systems
COMP 424 (3) Topics: Artificial Intelligence 1
COMP 426 (3) Automated Reasoning
COMP 431 (3) Algorithms and Data Structures
COMP 433 (3) Personal Software Engineering
COMP 538 (3) Person-Machine Communication