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 and Metallurgical Engineering

The Schools

Architecture
Urban Planning

STUDENT ELIGIBILITY

- full-time registration in an Engineering or Science undergraduate program with fewer than 45 credits and more than 15 credits remaining
- strong leadership/communication skills, good academic record (satisfactory standing)
- remain degree candidate and return to complete studies at McGill (internship students will receive an automatic extension

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

4 Academic Programs

Please note:

- Denotes courses not offered in 2001-02
  Complementary courses
  Courses with Limited Enrolment

Where asterisks appear with a prerequisite, they have the following significance:

* a D grade is acceptable for prerequisite purposes.

** under special circumstances, the Department may permit this course to be taken as a co-requisite.

The curricula and courses described in the following pages have been approved for the 2001-02 session, but the Faculty reserves the right to introduce changes as may be deemed necessary or desirable.

4.1 Faculty Courses

A number of Faculty courses are offered and are listed below. These courses are of a more general nature than the departmental courses.

300-220A LAW FOR ARCHITECTS AND ENGINEERS. 3(3-0-6)
Aspects of the law which affect architects and engineers. Definition and branches of law; Federal and Provincial jurisdiction, civil and criminal law and civil and common law; relevance of statutes; partnerships and companies; agreements; types of property, rights of ownership; successions and wills; expropriation; responsibility for negligence; servitudes/easements, privileges/liens, hypothecs/mortgages; statutes of limitations; strict liability of architect, engineer and builder; patents, trade marks, industrial design and copyright; bankruptcy; labour law; general and expert evidence; court procedure and arbitration. **Mtre J.A. Woods**

300-480A,B TECHNOLOGICAL ENTREPRENEURSHIP PROJECT.

Civil Engineering

Computer Science

Electrical and Computer Engineering

Mechanical Engineering

Metallurgical Engineering

Mining Engineering

Urban Planning

4.2 School of Architecture

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

Telephone: (514) 398-6700
Fax: (514) 398-7372
http://www.mcgill.ca/arch

Director — David Covo

Emeritus Professors

John Bland; B.Arch.(McG.), A.A. Dipl., D.Sc.(Carleton), R.C.A., F.R.A.I.C., O.A.Q. *(William C. Macdonald Emeritus Professor of Architecture)*

Norbert Schoenauer; B.Arch.(Bud.), M.Arch.(McG.), R.C.A., F.R.A.I.C., O.A.Q., C.P.U.Q., M.C.I.P. *(William C. Macdonald Emeritus Professor of Architecture)*

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)*

Alberto Pérez-Gómez; Dipl.Eng.(Nat.Pol.Inst.Mexico), M.A., Ph.D.(Essex) *(Saidye Rosner Bronfman Professor of*

Jane L. Cook, Cynthia Cooper, Milton Curry, Martine Dion, Georges Drolet, Aliki Economides, Wade Eide, Corinne Farazli, Karl Fischer, Francois Geraldeau, Nathan Godlovitch, Bob Hamilton, Jean-Paul Herby, Guy J. Joncas, Ron Keays, Mark Koot, Peter Lanken, Katherine Lapierre, Gilles L. Larose, Paul Laurendau, Barbara Lawson, Andrea MacElwee, Eric Marosi, Louis Martin, Grant McCracken, Carl Mulvey, Alina Payne, Mark Pimlott, Allessandra Ponte, Barry Sampson, Harm Scholtens, Andrea Simitch, Daniel Smith, Will Straw, Nadia Subotincic, Ken Taylor, Elizabeth Terragni, Katherine Venert, Andrea Wolff.

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

COURSES OFFERED BY THE SCHOOL

● Denotes courses not offered in 2001-02.
Denotes limited enrolment.
★ Denotes courses offered only in alternate years.

Unless otherwise indicated, students not registered in the

301-321A FREEHAND DRAWING III. 1(0-3-0) (Prerequisite: 301-218B) A continuation of course 301-218B. **Professor Nash**

301-322B FREEHAND DRAWING IV. 1(0-3-0) (Prerequisite: 301-321A) A continuation of course 301-321A. **Professor Nash**

301-324T SKETCHING SCHOOL I. 1(0-0-3) (Prerequisite: 301-218B) An eight-day supervised field trip in the late summer to

● **301-521B STRUCTURE OF CITIES.** 3(2-0-7) (Prerequisite: 301-202B or permission of instructor) Nature, pattern and life of modern cities. Urban networks, special areas, problems and prosects. **Professor Anderson**
Section 01: reserved for Architecture students.
Section 02: reserved for others. Limited enrolment; password card required.

301-522A HISTORY OF DOMESTIC ARCH. IN QUEBEC. 3(2-0-7) (Prerequisite: 301-251A) The architecture of houses in Quebec from 1650 to the present. Distinguished buildings are reviewed from the point of view of form, style, siting and material, as influenced by climate, culture and architectural antecedents in France, England and the United States. The course material is presented through alternating bi-weekly lectures and seminars. Limited enrolment; password card required. **Professor Anderson**

● ★ **301-523B SIGNIFICANT TEXTS & BUILDINGS.** 3(2-0-7) (Prerequisite: 301-251A) (Alternating with 301-524B.) Critical study of significant architectural thought since 1750 as it has been expressed in buildings and texts (treatises, manifestos, criticisms). A specific theme will be addressed every year to allow in-depth interpretations of the material presented and discussed. Limited enrolment; password card required. **Professor Castro**

★**301-524B SEMINAR ON ARCHITECTURAL CRITICISM.** 3(2-0-7) (Prerequisite: 301-251A) (Alternating with 301-523B.) The development and current role of architectural criticism with particular reference to its affinities with art and literary criticism. Limited enrolment; password card required. **Professor Castro**

301-525A SEMINAR ON ANALYSIS AND THEORY. 3(2-0-7) (Prerequisite: 301-202B or permission of instructor) Analysis and evaluation of significant architectural projects with reference to contemporary architectural theories. Limited enrolment; password card required. **Professor Zuk**

301-526B PHILOSOPHY OF STRUCTURE. 3(2-0-7) (Prerequisite: 301-202B or permission of Instructor) (Not open to students who have taken 301-374B.) Philosophy of Structure aims to investigate structure in its broadest sense. The course is divided in two halves;

the supervision of faculty and visitors on projects in the design and construction of environments for the disabled drawn from case histories of selected institutions. Course work may include group and individual field trips to hospitals, clinics or specific project sites. Limited enrolment. **Professors Gisel, Covo and visitors**

4.3 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
http://www.engineering.mcgill.ca/chem/index.htm

Chair — Richard J. Munz

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

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

CURRICULUM FOR THE B.ENG. DEGREE IN CHEMICAL ENGINEERING

REQUIRED COURSES		COURSE CREDIT
Non-Departmental Courses		
180-212A,B	Introductory Organic Chemistry I	4

If advanced credit is obtained for 189-260 Intermediate Calculus (see section 2.3), the total number of credits is reduced by three.

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

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.

For students admitted to the 8-semester program (see section 3.1.2), the additional courses are specified in *Welcome to McGill*, and can also be found on the Faculty website (http://www.engineering.mcgill.ca).

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 (see for example the Faculty list of courses in section 4.1.1).

The technical complementary courses currently approved by the Department are as follows:

Courses 481A and 581B comprise a Polymeric Materials sequence. Additional courses in this area are available in the Chemistry Department (e.g. 180-455A) or at the graduate level (302-681 to 684). The Department has considerable expertise in the polymer area.

Courses 370A and 474A 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: 302-471A and 302-472B. As some water pollution control problems are solved by microbial processes, course 302-474B 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 302-452B is also relevant. Additional courses in this area are listed under section 5.7.

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 Minor program appears in section 5.2.

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 (302-5XX level) courses as technical complementaries.

ELECTIVE COURSES

Students who have obtained exemptions for courses, i.e. for CEGEP courses equivalent to 180-212 or 180-234, 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

thermodynamics, fluid mechanics, heat and mass transfer, and

4.4 Department of Civil Engineering and Applied Mechanics

Macdonald Engineering Building, Room 492
817 Sherbrooke Street West
Montreal, QC H3A 2A7

Telephone: (514) 398-6860
Fax: (514) 398-7361
http://www.mcgill.ca/civil

Chair — Denis Mitchell

Emeritus Professors
Philip J. Harris; B.Sc.(Man.), M.Eng., Ph.D.(McG.), F.E.I.C., F.C.S.C.E., Eng.
Richard G. Redwood; B.Sc.(Eng.)(Bristol), M.A.Sc.(Tor.), Ph.D.(Bristol), F.C.S.C.E., F.I.Struct.Eng., Eng.
Stuart B. Savage; B.Eng.(McG.), M.S.Eng.(Cal.Tech.), Ph.D.(McG.), F.R.S.C.

Professors
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., Eng.
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.

Associate Professors
Luc E. Chouinard; B.Ing., M.Ing.(Montr.), B.C.L.(McG.), Sc.D.(M.I.T.), Eng.
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.

Assistant Professors
Susan J. Gaskin; B.Sc.(Queen's), Ph.D. (Canterbury)
Subhasis Ghoshal; B.C.E. (India), M.S.(Missouri), Ph.D. (Carnegie Mellon)
Colin Rogers; B.A.Sc.(Waterloo), M.A.Sc., Ph.D.(Sydney), P.Eng.
Yixin Shao; B.S., M.S.(Tongji), Ph.D.(Northwestern)

Adjunct Professors
Sofia Barbarutsi, Jordan Belovski, James Byrns, Claude Carette, Luc Danielse, Diane Girard, Serge Guiot, John Hadjinicolaou, Jean Hamaoui, Jalal Hawari, Lionel Hervieux, Catherine Hirou, Graham Holder, Robert D. Japp, Kenneth MacKenzie, John C. Osler, Vincent Patterson, Sandro Scola, David Stringer, William Taylor, Pierre Trottier, Jan Vrana, 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 [illegible]

COURSES OFFERED BY THE DEPARTMENT

- Denotes courses not offered in 2001-02

Where asterisks appear with a prerequisite, they have the following significance:

* a D grade is acceptable for prerequisite purposes.

** under special circumstances, the Department may permit this course to be taken as a co-requisite.

ticles. Work, conservative forces, potential energy. Relative motion and general moving frames of reference. Central force fields and orbits. Dynamics of a system of particles. General motion of rigid bodies, angular momentum and kinetic energy of rigid bodies. Generalized coordinates and forces, Lagrange's equations. **Professor Chu and Dr. Babarutsi**

303-283B STRENGTH OF MATERIALS. 4(4-1-7) (Prerequisite: 303-205A,B*) Structural behaviour, trusses, statically determinate beams, frames, and arches; moments of inertia, stress, strain, properties of materials; bending and shearing stresses; torsion; fixed and continuous beams; reinforced concrete beams; columns; combined stresses; Mohr's circle. **Dr. Babarutsi**

303-290A THERMODYNAMICS & HEAT TRANSFER. 3(3-2-4) Macroscopic vs. microscopic viewpoint; states and processes; energy conservation and transformation. Phase equilibrium; equations of state; thermodynamic properties; work; heat; First Law of thermo-

and development of water resources; and, legal and economic aspects. **Professor Nguyen**

303-553A STREAM POLLUTION AND CONTROL. 3(3-2-4) (Prerequisite: 303-225B) Water quality standards; physical, chemical, and bacterial contamination of surface waters; effects of specific types of pollution such as thermal, point and non-point sources; stream self-purification; effects on lake eutrophication; pollution surveys and methods of control; laboratory tests. **Professor Gehr**

303-554A ENVIRONMENTAL ENGINEERINGHE.SFOLQ9h TmENTAL

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

Assistant Professors
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.)
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)
Zilic Zeljko; B.Eng.(Zagreb), M.S.c, Ph.D.(Tor.)

Visiting Professor
Birendra Prasada; M.Sc.(Ban.), Ph.D.(Lond.)

Lecturer
Kenneth L. Fraser; B.Eng., M.Eng.(McG.), Eng.

Associate Members
Martin Buehler; M.Sc., Ph.D.(Yale)
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.)

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

***Enhanced ITT Concentration in Telecommunications**

The International Institute of Telecommunications (IIT) was recently established in Montreal as a center for telecommunications education. It is funded by government and industry, and provides state-of-the-art laboratory facilities and a point of contact between local telecommunications industries and universities.

304-530	Logic Synthesis	
304-526	Artificial Intelligence	
304-531	Real-Time Systems	
304-532	Computer Graphics	
304-548	Introduction to VLSI Systems	
308-420	File Systems	
308-431	Algorithms & Data Structures	
308-435	Basics of Computer Networks	
308-575	Fundamentals of Parallel Computing	

Laboratory Complementaries **4**
Two 400-level laboratory courses in Electrical Engineering

General Complementaries **9**
Two courses (6 credits) in Social Sciences, Administrative Studies or Humanities, selected from an approved list (category ii - section 3.4) and one course (3 credits) on the impact of technology (category i - section 3.4) in consultation with an academic advisor. At least one 3-credit course must be from category A (Humanities and Social Sciences) in section 3.4.

TOTAL CREDITS **110**

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

(subject to Ministry of Education approval)
(Program revision awaiting University approval)

		COURSE CREDIT	
REQUIRED COURSES			
304-221	Intro to Computer Engineering I	3	
304-222	Intro to Computer Engineering II	3	
304-321	Intro to Software Engineering	3	
304-427	Operating Systems	3	
304-428	Software Engineering Practice	3	
304-429	Software Validation	3	
304-495	Software Eng. Design Project	3	
308-202	Introduction to Computing I	3	
308-206	Intro Software Systems	3	
308-250	Intro to Computer Science	3	
308-251	Data Structures and Algorithms	3	
308-302	Programming Languages and Paradigms	3	
308-330	Theoretical Aspects of Computer Science	3	
308-360	Algorithm Design Techniques	3	
308-361	Systems Programming Project	3	
308-420	Files and Databases	3	**48**
Mathematics and Science Required Courses			
189-260	Intermediate Calculus	3	
189-261	Differential Equations	3	
189-270	Applied Linear Algebra	3	
198-230	Dynamics of Simple Systems	3	**12**
Mathematics Complementary Course			
189-363	Discrete Mathematics	3	**3**
or 189-381	Complex Variables & Transforms		
Engineering Breadth Required Courses			
304-200	Fundamentals of Electrical Engineering	3	
304-210	Circuit Analysis	3	
304-291	Electrical Measurements Lab	2	
304-303	Signals and Systems I	3	
304-305	Probability and Random Sig. I	3	
304-330	Electronic Circuits I	3	
455-206	Communication In Engineering	3	
306-310	Engineering Economy	3	
306-221	Engineering Professional Practice	1	**24**

Technical Complementaries **14 - 16**
Students must take 14-16 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

308-350	Numerical Computing
308-409	Concurrent Programming
308-424	Topics In Artificial Intelligence I
308-433	Personal Software Engineering
308-524	Theoretical Found. of Prog. Lang.
308-575	Fundamentals of Distributed Algorithms

Group B Technical Complementaries

304-304	Signals and Systems II
304-323	Digital Systems Design
304-404	Control Systems
304-411	Communications Systems I
304-412	Discrete Time Signal Processing
304-413	Communications Systems II
304-414	Intro. To Telecom Networks
304-421	Embedded Systems
304-422	Fault Tolerant Computing
304-420	Parallel Computing
304-424	Human-Computer Interaction
304-425	Computer Organization and Architecture
304-426	Microprocessor Systems
or 308-573	Microcomputers
304-504	Computer Control
304-522	Asynchronous Circuits and Systems
304-526	Artificial Intelligence
304-529	Image Processing & Communications
304-530	Logic Synthesis
304-531	Real-Time Systems
304-532	Computer Graphics
or 308-557	Fundamentals of Computer Graphics
308-305	Computer System Architecture
308-410	Mobile Computing
308-412	Software for e-commerce
308-505	r Systems

COURSES OFFERED BY THE DEPARTMENT

- Denotes courses not offered in 2001-02
  Denotes courses with limited enrolment

All courses with limitations listed for section A01 have a section A02 open to other students but with password control.

Courses with laboratory components: the average number of hours per week of scheduled lab time is indicated by the second of the three bracketed numbers after the course title, e.g. (1-3-2) means 3 hours per week. Lab schedules are determined at the start of classes.

304-200A,B FUNDAMENTALS OF ELECTRICAL ENGINEERING. 3(3-0-6) (Corequisites: 189-261 or 189-325) An introduction to part of the broad scope of electrical engineering: electrostatics, capacitance, conduction, magnetic fields, inductance, circuits and components, sine waves in time and space, electrical machines and transformers, signal amplification. **Professor McFee**
Section A01: Limited to Electrical Honours, Regular, and Computer Engineering students only.

304-210A,B CIRCUIT ANALYSIS. 3(3-1-5) (Prerequisite: 304-200) Circuit models, KCL and KVL, branch relations, resistive circuit

analysis, network theorems, one- and two-port networks, networks in sinusoidal steady-state, power considerations, transient analysis of first- and second-order networks, response to exponential driving functions, frequency response of networks.

Professor Levine

For A Term: Section A01: Limited to Electrical Honours and Computer Engineering students only.
For B Term: Section A01: Limited to Regular Electrical Engineering students only.

304-221A,B INTRODUCTION TO COMPUTER ENGINEERING I. 3(3-1-5) (Corequisite: 308-202) Data representation in digital computers. Boolean algebra. Basic combinational circuits; their analysis and synthesis. Elements of sequential circuits: latches, flip-flops, counters and memory circuits. Computer structure, central processing unit, machine language. Assemblers and assembler language. **Professor Ferrie**

Section A01: Limited to Electrical Honours, Regular, and Computer Engineering students only.

304-222A,B INTRODUCTION

formers, direct-current motors, synchronous motors and generators, three phase and single phase induction machines. Elements of modern electronically controlled electric drive systems.
Professor Galiana

304-462B ELECTROMECHANICAL ENERGY CONVERSION. 3(3-0-6) (Prerequisite: 304-361) Lumped parameter concepts of electromechanics. Energy, co-energy in the derivation of torques and forces. Examples of electric machines: - dc, synchronous and induction types. Steady-state, transient and stability analysis. Power electronic controllers. **Professor Ooi**

304-464B POWER SYSTEMS ANALYSIS I. 3(3-0-6) (Prerequisite: 304-361) Basic principles of planning and operating interconnected power systems with emphasis on Canadian conditions. Mathematical models for system. Steady-state analysis of power systems, load flow formulation and solution algorithms. Operating strategies, economic dispatch, voltage reactive power regulation, frequency and tie-line power control. **Professor Galiana**

● **304-472A SYSTEMS DESIGN.** 3(2-2-5) (Prerequisite: At least 42 credits of Departmental courses and permission of the instructor.) A design course where the class works as a team to design a large project in either control, power, communications or computer systems. The design is carried out in close collaboration with an industrial partner who acts as a consultant to the project. **Staff**

304-485B IC FABRICATION LABORATORY. 2(1-3-2) (Prerequisite: 304-334, 455-206. Corequisite: 304-432 or 304-533) Essential processes for silicon semiconductor device fabrication: etching, diffusion, photolithography. Fabrication of large area PN junctions, selective area PN junctions and MOSFETs. Design and fabrication of simple MOS circuits. Electrical characterization of devices and circuits. Limited Enrolment (8). **Professor Shih**

304-486B POWER L

frequency domain. Sampled-data implementation of continuous-time design. **Professor Bélanger**

304-503B LINEAR STOCHASTIC SYSTEMS I. 3(3-0-6) (Prerequisites: 189-587 or 304-510) Stochastic processes: stationary processes, the Wold decomposition. The spectral representation theorem. Linear stochastic systems. Estimation Theory: Wiener-Kolmogorov prediction theory, Kalman filtering. Stochastic realization theory. Linear quadratic control theory. **Professor Caines**

● **304-504B COMPUTER CONTROL.** 3(3-0-6) (Prerequisites: 304-404 or 304-502 and 304-305) Sampling and aliasing. Conversion of continuous-time controllers using s-to-z transformations; pre- and post-filtering. Discrete time state representation and z-transfer function of sampled linear, time-invariant systems. Correspondence between system theoretic results for continuous- and discrete-time systems. Sampled-data design, including deadbeat and LQG control. Quantization. Specification of computer system. Study of control system design through case studies. **Staff**

304-505B NONLINEAR CONTROL SYSTEMS. 3(3-0-6) (Prerequisite: 304-501) Basic ODE formulation of non-linear systems; structural properties; Lyapunov and LaSalle stability theory and nonlinear and multivariable controller design; input-output stability; small gain theorem, conservation, passivity; system linearization, zero and inverse dynamics and regulator design; discontinuous and sliding mode control; applications to deterministic adaptive control. **Professors Caines and Michalska**

304-507A OPTIMIZATION AND OPTIMAL CONTROL. 3(3-0-6) (Prerequisites: 189-265 or 189-248 and 189-270 or 189-247) General Introduction to optimization methods including steepest descent, conjugate gradient, Newton algorithms. Generalized matrix inverses and the least squared error problem. Introduction to constrained optimality; convexity and duality; interior point methods. Introduction to dynamic optimization; existence theory, relaxed controls, the Pontryagin Maximum Principle. Sufficiency of the Maximum Principle. **Professor Michalska**

304-509A PROBABILITY AND RANDOM SIG. II. 3(3-0-6) (Prerequisites: 304-304 and 304-305) Multivariate Gaussian distributions; finite-dimensional mean-square estimation (multivariate case); principal components; introduction to random processes; weak stationarity: correlation functions, spectra, linear processing and estimation; Poisson processes and Markov chains: state processes, invariant distributions; stochastic simulation. **Staff**

304-510B RANDOM PROCESSES. 3(3-0-6) (Prerequisite: 304-509) Finite-dimensional distribution functions. Estimation, Orthogonal Projection Theorem. Linear stochastic systems; Kalman filtering. Stationary stochastic processes: spectral Representation Theorem, Wiener filtering, Wold decomposition; ARMA processes. Brownian Motion; Ito integral and stochastic differential equations; forward and backward equations for diffusions. Ergodic theorems. Stochastic dynamic programming. Applications to communication and control systems. **Professor Caines**

304-511A INTRO. TO DIGITAL COMM. 3(3-0-6) (Prerequisite: 303-304. Corequisite: 304-509.) (An advanced version of 304-411.) Amplitude and angle modulation including AM, FM, FDM and television systems; introduction to random processes; sampling and quantization, PCM systems, TDM; digital modulation techniques, Maximum-Likelihood receivers, synchronization issues; elements of information theory including information sources, source coding and channel capacity. **Professor Leib**

304-512A DIGITAL SIGNAL PROCESSING I. 3(3-0-6) (Prerequisite: 304-304 and 304-305) Review of discrete-time transforms, sampling and quantization, frequency analysis. Structures for IIR and FIR filters, coefficient quantization, roundoff noise. The DFT, its properties, frequency analysis and filtering using DFT methods, the FFT and its implementation. Multirate processing, subsampling and interpolation, oversampling techniques. **Professor Kabal**

● **304-513B ANALOG CIRCUIT SIMULATION.** 3(3-0-6) (Prerequisite: 304-334) Formulation of network equilibrium equations - tableau formulation. Solution in the frequency domain - sparse matrix techniques. The dc solution - electronic models, solution of nonlinear algebraic equations. Solution in the time domain - dynamic models, solution techniques for stiff systems. Design and optimization - sensitivity analysis in the frequency domain, tolerancing. Time domain design. Limited Enrolment (20). Password Card required. **Professor Rumin**

304-521A DIGITAL COMMUNICATIONS I. 3(3-0-6) (Prerequisite: 304-411 or 304-511. Corequisite: 304-509) Modulation: orthogonal and biorthogonal signalling, MPSK, QAM, modulation with memory. Detection: coherent, noncoherent and differentially coherent detection, performance issues and channel capacity, synchronization. Coding: block and convolutional codes, fast Hadamard Transform decoding, Viterbi algorithm, turbo-codes. Band-limited channels: intersymbol interference , spectral shaping, correlative coding, data estimation and channel equalization. **Professor Kabal**

304-522A ASYNCHRONOUS CIRCUITS AND SYSTEMS. 3(3-3-3) (Prerequisite: 304-323) Specification of asynchronous behaviors. Asynchronous logic components. Hierarchical design and verification. Concurrency issues: deadlock, livelock, starvation, safety. Timing issues. Modern design styles: handshaking, micropipelines. Asynchronous analysis models for protocols and software. **Professor Negulescu**

304-523B SPEECH COMMUNICATIONS. 3(3-0-6) (Prerequisite: 304-412 or 304-512) Articulatory and acoustic descriptions of speech production, speech production models, speech perception, digital processing of speech signals, vocodors using formant, linear predictive and cepstral techniques, overview of automatic speech recognition systems, speech synthesis systems and speaker

304-530B LOGIC SYNTHESIS. 3(3-2-4) (Prerequisite: 304-323) The place of logic synthesis in microelectronics. Representations of Boolean functions: logic covers, binary decision diagrams.Two-level synthesis algorithms, Espresso. Multi-level synthesis to Boolean networks: don't care methods, algebraic optimizations, delay modelling. Sequential synthesis: state-based optimizations, state assignment, network optimizations. Technology mapping: library cell and FPGA mapping. **Professor Zilic**

304-531B REAL TIME SYSTEMS. 3(3-3-3) (Prerequisites: 304-222 and 304-323) Real-time engineering applications of computers to on-line control, communication systems and data acquisition. Aspects of hardware, software, interfacing, operating systems, and their integration into a complete system are addressed. **Staff**

304-532A COMPUTER GRAPHICS. 3(3-3-3) (Prerequisite: 304-222) Introduction to computer graphics systems and display devices: raster scan, scan conversion, graphical input and interactive techniques - window environments; display files: graphics languages and data structures: 2D transformations; 3D computer graphics, hidden line removal and shading; graphics system design; applications. Laboratory project involving the preparation and running of graphics programs. **Ms. Leszkowicz**

304-533B PHYSICAL BASIS OF SEMICONDUCTOR DEVICES. 3(3-0-6) (Prerequisites: 304-330, 304-351 and 198-271) Quantitative analysis of diodes and transistors. Semiconductor fundamentals, equilibrium and non-equilibrium carrier transport, and Fermi levels. PN junction diodes, the ideal diode, and diode switching. Bipolar Junction Transistors (BJT), physics of the ideal BJT, the Ebers-Moll model. Field effect transistors, metal-oxide semiconductor structures, static and dynamic behaviour, small-signal models. **Professor Plant**

304-534A ANALOG MICROELECTRONICS

Huygens diffraction theory, Fourier optics, Gaussian beams, propagation characteristics of optical fibers and dielectric waveguides for wideband optical fiber communication systems, waveguide group velocity and dispersion, thin-film waveguides. Discussion of optical fiber communication systems and guided-wave photonic devices. **Staff**

GRADUATE 600-LEVEL COURSES

Generally, undergraduate students are not permitted to enroll in graduate 600-level courses. However, in exceptional circumstances, the Faculty of Graduate Studies and Research does grant this permission upon the request of the Department on behalf of the student. Please consult the Faculty of Graduate Studies and Research Calendar for 600-level courses.

4.6 Department of Mechanical Engineering

Students entering in September or January must plan their program of studies in accordance with the regulations described in *Welcome to McGill*. After registering by MARS, students must consult with their academic advisor.

In addition students admitted to the 8-semester program (see section 3.1.2), must take note of the additional courses that are specified in *Welcome to McGill.* These can also be found on the Faculty website (http://www.engineering.mcgill.ca).

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

TYPICAL PROGRAM OF STUDIES FOR REGULAR OR HONOURS

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

Semester 1 (Fall)

Semester 2 (Winter)

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

AERONAUTICAL ENGINEERING OPTION
Students in this Option should take five courses in the area of Aeronautical Engineering. Specifically they must take the following two required courses:

and at least one of the following:

The remaining two courses may be chosen from the above or from the following courses:

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 Option.

DESIGN OPTION
The Design Option Program is comprised of six courses as follows:

Plus any four below:

MECHATRONICS OPTION
Students in this option should take six courses in the area of

COURSES OFFERED BY THE DEPARTMENT

- Denotes courses not offered in 2001-02
  Complementary courses
  Courses with Limited Enrolment

305-201A INTRODUCTION TO MECHANICAL ENGINEERING. 2(3-0-3) The practice of Mechanical Engineering: its scope and context. The role of Design. Introduction to the Design process. The role of engineering analysis and socio-economic factors in Design. Introduction to the individual mechanical engineering subjects and their role in Design. Case studies. **Professor Ahmed and Staff**

305-210A,B MECHANICS I. 4(4-1-7) Basic principles of Newtonian mechanics. Kinematics, relative motion, momentum, forces (gravity, friction, elastic, etc.), pseudo-forces, impulse, energy (kinetic and potential) and mechanical work. Conservation of momentum and angular momentum, central force motion, centre of mass and moment of inertia. Engineering applications including beams, trusses, frames, mechanisms. **Professors Misra and Zsombor-Murray**

305-220A,B MECHANICS II. 3(3-1-5) (Prerequisites: 305-210 and 189-260. Pre- or Co-requisite: 189-261) Newtonian and Lagrangian formulations of mechanics. Solution of equations of motion for simple systems. Degrees of freedom, generalized coordinates and constraints. Energy methods. Equilibrium and stability of mechanical systems. 3-dimensional rigid-body dynamics; Euler's equations. Gyroscopic motion. **Professors Epureanu and Higgins**

305-240A,B THERMODYNAMICS I. 3(3-1-5) Thermodynamic systems and properties. First law of thermodynamics: energy, work and heat. State principle, p-v-T surfaces, phase equilibrium, ideal gas model. Second law of thermodynamics, entropy, exergy analysis. Energy analysis applied to steady and transient engineering systems including heat engines, refrigerators and heat pumps, air compressors. **Professors J.Lee, Frost, Mydlarski and Baliga**

305-260A,C MACHINE TOOL LAB. 2(1-3-2) Basic machine tool operations, numerical control of machine tools, and metrology. The use of hand tools, and sheet metal work. Introduction to rapid prototyping and nontraditional machining methods. Extensive laboratory hands-on exercises. **R. Sumner and Staff**

305-261B,C MEASUREMENT L

of passive elements. Semiconductors, amplifiers, filters, oscillators, modulators, power supplies and nonlinear devices. Introduction to digital electronics. Transducer/signal conditioner interfacing considerations. **Mr. Zorbas**

305-393B DESIGN II. 3(3-3-3) (Prerequisite: 305-292. Pre- or co-requisites: 305-314 and 306-260) The design of machine elements for strength requirements in consideration of various methods of manufacture. Synthesis of mechanical systems to fulfill perform-

the earth's oblateness, solar-lunar attraction, solar radiation pressure and atmospheric drag. Attitude dynamics of a rigid spacecraft; attitude stabilization and control; attitude maneuvers; large space structures. (Course description change awaiting University approval) **Professor Misra and Staff**

305-543B DESIGN WITH COMPOSITE MATERIALS. 3(3-3-3) (Prerequisite: 305-530) Material systems/selection process. Cost vs performance. Laminate layup procedures. Theory and application of filament winding of composite cylinders. Regular oven and autoclave oven curing, analysis of resulting material performance. Practical design considerations and tooling. Analysis of environmental considerations. Joining techniques. Analysis of test methods. Theory of repair techniques. **Professor Lessard**

305-545A ADVANCED STRESS ANALYSIS. 3(3-1-5) (Prerequisites: 303-207 and 305-321) Tensor Analysis: Review of continuum mechanics. Equilibrium and constitutive equations in tensor form. Finite element methods. Torsion of non-circular cross-sections; spherical problems; advanced airy stress function problems. Introduction to plates and shells. Thermal deformations and stresses. Introduction to plasticity and viscoelasticity. **Professors Nemes andLessard**

305-552B ADVANCED APPLIED MATHEMATICS. 3(3-1-5) (Prerequisite: 305-452) Solutions of ordinary differential equations using integral methods; asymptotic series, Stirling's approximation. Bessel and Laguerre functions. Green's functions. Laplace, Helmholtz, diffusion, wave, telegraph partial differential equations. Variational methods. Numerical solutions to partial differential equations. **TBA**

305-554A MICROPROCESSORS FOR MECH345R

4.7 Department of Mining and Metallurgical Engineering

306-341B	Introduction to Mineral Processing	3	
306-324B	Electrotechnology for Mining, Metallurgical and Materials Engineers	3	
306-350B	Extractive Metallurgical Engineering	3	
306-352A	Hydrochemical Processing	3	
306-354C	Process Engineering Laboratory	2	
306-355A	Heat, Mass and Fluid Flow	3	
306-360A	Phase Transformations in Solids	3	
306-362A	Engineering Materials	3	
306-380B	Industrial Training II	2	
306-410B	Research Project	3	
306-412C	Corrosion and Degradation	3	
306-442A	Modelling in Mineral Processing	3	
306-450B	Process Design	3	
306-455B	Advanced Process Engineering	3	
306-456B	Steelmaking and Steel Processing	3	
306-463B	Deformation Processing of Materials	3	
306-465A	Ceramic Engineering	3	
306-480T	Industrial Training III	2	
306-481A	Industrial Training IV	2	**79**

COMPLEMENTARY COURSES

Technical Courses **6**

Two courses may be taken; one of these can be chosen from the Faculty list (see section 4.1.1).

NOTE: Not all courses are given annually; verification with course instructor is advised.

302-481A	3	Polymer Engineering
306-361B	3	Liquid State Processing of Materials
306-367B	3	Electronic Properties of Materials
306-451A	3	Environmental Controls
306-457B	3	Light Metals Extraction
306-515A	3	Advanced Metallurgical and Materials Thermodynamics
306-544A	3	Mineral Processing Systems I
306-545B	3	Mineral Processing Systems II
306-551B	3	Electrochemical Processing
306-555A	3	Thermal Remediation of Wastes
306-560B	3	Joining Processes
306-561A	3	Materials Design and Selection
306-563A	3	Hot Deformation of Metals
306-564B	3	X-ray Diffraction Analysis of Materials
306-566B	3	Texture, Structure and Properties of Polycrystalline Materials
306-567B	3	Aluminum Casting Alloys
306-569B	3	Electron Beam Analysis of Materials

Advanced credit is given for 189-260 Intermediate Calculus upon successful completion of a placement test (see section 2.3).

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

Advanced credit is given for 189-260 Intermediate Calculus upon successful completion of a placement test (see section 2.3).

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

Student Advising

Students entering the Mining or Metallurgical Engineering programs must plan their schedule of studies in consultation with one of the departmental advisors: Professors Harris and Kozinski (Metallurgy) or Mr. J. Mossop (Mining).

COURSES OFFERED BY THE DEPARTMENT

- Denotes courses not offered in 2001-02
  Complementary Courses

Courses offered by the Department have been numbered to conform with the following classification system. The first three digits (i.e. 306) represent the departmental code. The next digit is the level of instruction. The last two digits are classified as follows:

DEPARTMENTAL METALLURGY COURSES

Courses associated with the CO-OP program in Mining Engineering are listed separately following this section.

306-202A ENG. COMMUNICATION SKILLS. 2(1-2-3) Basic forms of engineering communication: memoranda, executive summaries, letters, proposals, evaluations, oral presentations and presentation graphics, email, groupware, workflow, internet, graphics and presentation tools. Adaptation into engineering. Short assignments and oral presentations. **Professor Harris**

306-209B MATHEMATICAL APPLICATIONS. 3(3-2-4) Introduction to stochastic modelling of mining and metallurgical engineering processes. Description and analysis of data distributions observed in mineral engineering applications. Modelling with linear regression analysis. Taylor series application to error and uncertainty propagation. Metallurgical mass balance adjustments.
Professor Laplante

306-212B ENGINEERING THERMODYNAMICS. 3(3-1-5) Macro versus microscopic approach: patterns of Nature. First and second laws and their use. Property relationships: free energies, chemical potentials, activities, heat capacity. Chemical equilibrium. Reaction kinetics. Phase equilibrium for a pure substance. Experimental methods. Engineering applications: high-temperature metallurgical reactors, turbines, mixtures and solutions, phase diagrams, superconductivity. **Professor Kozinski**

306-250A INTRODUCTION TO EXTRACTION METALLURGY. 3(2-3-4) Raw materials, processes and products of metallurgical operations. Mineral processing: comminution including size classification, separation of minerals with emphasis of flotation, waste disposal. Extractive metallurgy: roasting, smelting, refining, hydrometallurgy, environmental protection. **Professors Finch and Mossop, and Staff**

306-260A,B MATERIALS SCIENCE AND ENGINEERING. 3(2-2-5) Structure properties and fabrication of metals, polymers, ceramics, composites; engineering properties: tensile, fracture, creep, oxidation, corrosion, friction, wear; fabrication and joining methods; principles of materials selection. **Professors Drew and Jonas**

306-280T INDUSTRIAL TRAINING I. 2 Four-month work period in industry. Work term report required upon completion.
Professor Finch

306-308A SOCIAL IMPACT OF TECHNOLOGY. 3(3-0-6) (Enrolment encouraged by students outside the Faculty of Engineering.) Critical examination of the socio-economic costs and benefits of technology, case studies of old engineering works and new technologies. The integration of applied ethics and engineering practice, analysis of basic concepts of technology assessment, the inter-connected processes of risk assessment, management, and communication. **Staff**

● **306-311B MODELLING AND AUTOMATIC CONTROL.** 3(3-2-4) (Prerequisite: 308-208A,B) Mass and energy conservation laws. Dynamic versus steady state models, dynamic behaviour of first and higher order metallurgical systems, linear and nonlinear models, interacting and noninteracting systems. Laplace domain dynamics and transfer functions. Feedback control, control valves and controllers, transducers. Feedback-feedforward control, introduction to cascade, adaptive and statistical control strategies. Digital computer control, instruments and interfaces.
Professor Hasan

306-317C MATERIALS CHARACTERIZATION. 3(2-3-4) (Prerequisite: 306-260A,B) Bulk, surface and microanalytical techniques for materials characterization. Bulk analysis: spectrophotometry using UV, visible, flame and atomic absorption, x-ray diffraction and x-ray fluorescence. Surface and microanalysis: infrared spectroscopy, scanning and transmission electron microscopy, Auger electron and x-ray photoelectron spectroscopy.
Professors Szpunar, Kozinski and Yue

306-341B INTRODUCTION TO MINERAL PROCESSING. 3(2-3-4) (Prerequisite: 306-250A) Theory and practice of unit operations including: size reduction-crushing and grinding; size separation-screening and classification; mineral separation-flotation, magnetic and gravity separation. Equipment and circuit design and

reversible cells and potentials; electrode kinetics, overpotential and potential-current laws; industrial applications; electrolytic winning and refining, electroplating, surface cleaning and coating, electrodialysis and electrochemical sensors.
Professor Demopoulos

● **306-555A THERMAL REMEDIATION OF WASTES.** 3(3-0-6) (Prerequisites: 180-111B and 306-212B or equivalent) Process technology and environmental concerns in thermal remediation of wastes. Design of thermal remediation systems. Waste combustion. Nature and pathways of pollutant streams during thermal treatment of wastes. Reduction and control of harmful products. Toxic metal encapsulation. Particulate removal. Destruction of gaseous contaminants. Use of models in system design.
Professor Kozinski

● **306-560B JOINING PROCESSES.** 3(3-3-3) (Prerequisite: 306-361B or equivalent) Physics of joining; interfacial requirements; energy sources, chemical, mechanical and electrical; homogeneous hot-joining, arc-, Mig-, Tig-, gas-, thermite- and Plasma-welding; Autogeneous hot-joining, forge-, pressure-, friction-, explosive-, electron beam- and laser-welding; Heterogeneous hot-joining, brazing, soldering, diffusion bonding; Heterogeneous cold joining, adhesives, mechanical fastening; Filler materials; Joint metallurgy; Heat affected zone, non-metallic systems; joint design and economics; defects and testing methods. **Mr. Vaidya**

● **306-561A MATERIALS DESIGN AND SELECTION.** 3(0-4-5) (Prerequisite: 306-362A or equivalent) Advanced topics in materials design problems. Discussion and laboratory work, supplemented by detailed technical reports. Special attention is given to selection, design and failure problems in various materials systems.
Professors Drew and Gruzleski

306-563A HOT DEFORMATION OF METALS. 3(2-2-5) (Prerequisite: 306-463B and 306-360A) High temperature deformation processing of metallic materials. Topics include static and dynamic recrystallization, recovery, precipitation; effect of deformation on phase transformations and microstructural evolution during industrial processing. Mathematical modelling of microstructural evolution. **Professor Yue**

● **306-564B X-RAY DIFFRACTION ANALYSIS OF MATERIALS.** 3(2-3-4) (Prerequisite: 306-317A) The techniques of X-ray and neutron diffraction are discussed as applied to the minerals and materials production industries. Special emphasis is placed upon automated X-ray powder diffractometry as employed for determining the structure and composition of materials. The application of X-ray techniques to studies of crystal structure, crystal orientation, residual stress, short-range order in liquid metals, phase diagram determination, order-disorder transformation and chemical analysis are presented. **Professor Szpunar**

● **306-566B TEXTURE, STRUCTURE & PROPERTIES OF POLYCRYSTALLINE MATERIALS.** 3(2-3-4) (Prerequisite: 306-317A) Concepts and quantitative methods for the description of the structure of minerals and materials are discussed. Special emphasis is placed on experimental techniques of texture measurement. Procedures are demonstrated for the control of deformation and recrystallization textures in order to obtain the properties required of industrial products. Finally, the correlation between texture and the anisotropy of elastic, plastic and magnetic properties of engineering materials is described and analyzed. **Professor Szpunar**

306-567B ALUMINUM CASTING ALLOYS. 3(3-0-6) (Prerequisite: 306-361B or equivalent) The family of aluminum foundry alloys; alloy systems, intermetallic phases and their formation, heat treatment processes, mechanical and physical properties of aluminum casting alloys, foundry properties, eutectic modification, porosity formation, gassing and degassing, refinement of hypereutectic alloys, grain refinement, filtration; non destructive control of microstructure. **Professor Gruzleski**

306-569B ELECTRON BEAM ANALYSIS OF MATERIALS. 3(2-3-4) (Prerequisite: 306-317A) Emphasis on operation of scanning and transmission electron microscopes. Topics covered are electron/specimen interactions, hardware description; image contrast description; qualitative and quantitative (ZAF) x-ray analysis; electron diffraction pattern analysis. **Professor Yue and Ms. Campbell**

DEPARTMENTAL MINING COURSES

306-200A MINING TECHNOLOGY. 3(3-3-3) Economic importance of the mining industry. Definition of a mining venture, and responsibilities of the mining engineer. Relevant legislation, regulations, and professional organizations. Criteria for exploiting an ore deposit. Surface and underground mining methods: preliminary selection procedure. Mining methods and mining equipment. Ethics and professionalism in the practice of engineering.
Mr. Mossop

306-203C MINE SURVEYING. 2 (Prerequisite: 306-200 or permission of instructor) A two-week field school with laboratories and assignments. The role of the mine surveyor. Techniques and instrumentation for measurement of levels, angles and distances. Shaft, raise, drift and stope surveying techniques. Graphical presentation of survey data and computer applications. Monitoring techniques for mining excavations with deformation and displacement measurements. **Dr. Momayez and Mr. Vachon**

306-221A,B ENGINEERING PROFESSIONAL PRACTICE. 1(1-0-2) Professional practice and ethics, professional liability, occupational health and safety, environmental responsibility. University Code of Student Rights and Responsibilities. **Professors Ouellet and Hassani**

306-290T INDUSTRIAL WORK PERIOD I. 2 (Prerequisites: 306-200 or 306-203) A four-month work period in the mineral industry, s6s, indu6bx6s, indu

306-324B ELECTROTECHNOLOGY FOR MINING, METALLURGICAL & MATERIALS ENGINEERS. 3(3-3-3) (Prerequisites: 189-261 and 189-265) AC theory including vector and complex number representation of sinusoidal currents, voltages and impedances. Effect of frequency on LCR circuit outputs. Logic circuits including two-state logic and logic components, logic ports and toggles, Boolean algebra, and complex circuits. Microprocessors including organization logic, programming, and microcomputers. Data acquisition including sensors, noise, A/D and D/A converters, and programming. Operational amplifiers. Applications to systems control. **Mr. Thom**

306-325A MINERAL INDUSTRY ECONOMICS. 3(3-1-5) (Prerequisite: 306-310) Geographical distribution of mineral resources. Production, consumption and prices of minerals. Market structure of selected minerals. Economic evaluation aspects: grade-tonnage considerations; capital and operating cost estimation; assessment of market conditions; estimation of revenue; taxation; sensitivity

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 Faculty of Graduate Studies Calendar (available on the web at http://www.aro.mcill.ca).

While the School of Urban Planning is a graduate progam, a number of undergraduate courses are taught by the faculty members affiliated with the School. These are listed below.

UNDERGRADUATE COURSES OFFERED BY THE SCHOOL

409-501A,B PRINCIPLES AND PRACTICE I. (2) This six-week intensive course exposes students to issues and techniques that are applicable in diverse professional planning contexts. The subject matter, geographic area, scale of intervention and institutional location of planning varies from semester to semester. The course focuses on a specific case study and is taught by a visiting lecturer with professional experience in the selected subject matter.
Staff and Visitors

409-505B GEOGRAPHIC INFORMATION SYSTEMS. (3) An introduction to fundamental geographic information system (GIS) concepts and a range of GIS applications in urban and regional planning.
Professor Brown

UNDERGRADUATE COURSES OFFERED JOINTLY BY THE SCHOOL AND OTHER ACADEMIC UNITS

183-351A APPLIED QUANTITATIVE METHODS IN GEOGRAPHY. (3) Survey design; uni- and multi-dimensional scaling; cost-benefit analysis and matrix methods of plan evaluation; multiple regression and correlation; logic models; gravity models; population projection. **Professor Ewing**

301-550B URBAN PLANNING I. (2) Theory and practice. An examination of different basic approaches to urban planning with special reference to Quebec. **TBA**

301-551A URBAN PLANNING II. (2) Urban Design and Project Feasibility. Theory and practice. The course considers the urban and real-estate development process, with a focus on economic and political constraints. It introduces students to techniques in urban

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 Biotechnology heading on page 374 of the Science section.

A Chemical Engineering student may complete the Biotechnology Minor by taking 177-200A, 177-201B, 177-202B, 528-211A, 202-505B, plus one course from the list of additional courses not including 306-310. The Department of Chemical Engineering permits students in the Minor program to complete 202-505B as one

A. ENGINEERING COURSES (21 credits)

Agricultural Engineering (Macdonald Campus)

Chemical Engineering

Civil Engineering and Applied Mechanics

Mechanical Engineering

Mining and Metallurgical Engineering

B. NON-ENGINEERING COURSES (6 credits)

Agricultural Sciences (Macdonald Campus)

Anthropology

Atmospheric and Oceanic Sciences

Biology

Chemistry

Earth and Planetary Sciences

Economics

Geography

Law

Microbiology and Immunology

Religious Studies (Macdonald Campus)

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. Email: 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 472 in the MSE section.

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 306-310 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 306-310.

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 280-211, a course in statistics, and a course in micro-economics are prerequisite for 280-341. If included in the Minor in Management, 280-423 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)

280-211 Introduction to Financial Accounting
280-320 Managing Human Resources

Complementary Courses (9 credits)

3 credits, one of List A:

280-213 Introduction to Managerial Accounting
280-341 Finance I
280-373 Operations Research
280-382 International Business

3 credits, one of List B:

270-462 Management of New Enterprises
or 270-465 Technological Entrepreneurship
280-222 Organizational Behaviour
280-352 Marketing Management I
or 275-360 Marketing of Technology
280-360 Social Context of Business
280-423 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 280-373. There are three courses in Engineering that qualify: 303-208, 305-474 and 309-326. It should be noted that 280-373 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)

306-260A,B Materials Science and Engineering
or 302-380A Materials Science
306-367B Electronic Properties of Materials
306-465B Ceramic Engineering
302-481A Polymer Engineering
302-484B Materials Engineering

Complementary Courses (9 credits)

Three courses to be chosen from the following list:

180-455A Introductory Polymer Chemistry
302-381B Polymer Technology
302-483B Industrial Rheology
302-487B Chemical Processing in the Electronics Industry
302-530C Structure and Properties of Paper
302-581B Polymer Composites Engineering
304-545A Microelectronics Technology
305-530B Mechanics of Composite Materials
306-360A Phase Transformations in Solids
306-361B Liquid State Processing of Materials
306-362A Engineering Properties of Materials
306-412A Corrosion and Degradation
306-560A Joining Processes
306-561B Advanced Materials Design
306-563B Hot Deformation of Metals
306-564B X-Ray Diffraction Analysis of Materials
306-566A Texture, Structure and Properties of Polycrystalline Materials
306-569B 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 189-247 (or -223), -260 (or -222), -261 (or -315 or -325), -265 (or -248 or -314), -266, -270, -319.

At least 18 credits must be chosen from the Mathematics and Statistics courses approved for the Mathematics Majors or Honours program, or from Mathematics 189-249, -363, -381, -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:

198-253B Thermal Physics
198-357A Quantum Physics I
198-457B Quantum Physics II

and at least 9 credits chosen from the following:

198-332B Physics of Fluids
198-362B Statistical Mechanics
198-451B Classical Mechanics
198-516B6Wq8p

Students who take 198-357A and 198-457B can omit 198-271B 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.

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