

## **Calendar Home**

### **One Hundred and Twenty Sixth Session**

The Calendar on the Engineering and Applied Science website is an official publication of the Faculty Board. This Calendar is the prevailing and official record of the academic regulations, academic plans of study, descriptions of courses of instruction, and requirements for graduation in all undergraduate plans in the Faculty. It can only be amended by Faculty Board. Amendments will be recorded in the Minutes of the Board and are included in the on-line Calendar.

**Students looking for the 2017-2018, 2018-2019 or 2019-2020 Calendar, please use the dropdown menu above to the right of your screen. For calendars prior to the 2015-2016 Academic Calendar, please [click here](#)**

### **About this Calendar**

This online calendar (acalog™) contains a number of features that can assist you with your academic planning. Some of these features include:

1. Advanced, easy-to-use search options
2. Intuitive navigation
3. Printable Degree Planners
4. Personal Portfolio to store favourite programs, courses and pages
5. Print-friendly pages

For information on how to use these features, please see our [FEAS Calendar User Guide](#) .

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## **Glossary**

### **Academic Plan**

A specified combination of courses leading to a degree in a particular subject.

### **Academic Program**

Refers to the degree program of study that a student is pursuing, i.e., Bachelor of Applied Science or special programs such as UASC, UBUS, UEDU.

### **Associate Dean (Academic)**

In charge of undergraduate studies for the Faculty.

### **AU**

Academic Units, numerically equal to CEAB Accreditation Units.

### **Board of Trustees**

The senior administrative body of the University.

### **BTech**

Bachelor of Mining Engineering Technology

### **Bursary**

Financial award for a student in need.

### **Calendar**

An official publication of academic regulations, plans of study, descriptions of courses of instruction, and requirements for graduation.

### **CEAB**

Canadian Engineering Accreditation Board.

### **CS: Complementary Studies**

Topics in Engineering Economics, Communications, Management, Humanities and Social Sciences, Linkage and Professional Issues, and Performance Arts and Languages.

## **Confidential Examination**

An examination paper recovered after the examination and withheld from circulation or publication.

## **Core**

Those courses which are a mandatory part of an academic plan.

## **Corequisites**

Courses which must be taken at the same time as the course in question, or have previously been taken and passed.

## **Credit**

To attribute to an academic record, the accreditation units for a similar course of instruction.

## **Dean**

The Chief Executive Officer of the Faculty.

## **Department**

A subdivision of the Faculty responsible for a particular subject or group of related subjects, or an academic plan.

## **ECGPA**

Engineering Cumulative Grade Point Average - see Regulation 16c for definition.

## **EGGPA**

Engineering Graduation Grade Point Average - see Regulation 3 for definition.

## **Electives**

A group of courses from which a specified number must be chosen to satisfy part of the requirements for the degree.

## **Engineering Design**

Development of elements, systems and processes using mathematics, science and engineering science to meet specific needs and constraints.

## **Engineering Science**

Application of mathematics and basic sciences to the identification and solution of engineering problems.

## **Engineering Session**

Defined as the Fall and Winter terms of the academic year, provided the student is registered in the FEAS for both of these sessions.

## **Engineering Student**

A student registered in the FEAS.

## **ETGPA**

Engineering Term Grade Point Average - see Regulation 3 for definition.

## **Exemption**

A required course replaced in an academic plan by relevant Work Experience plus an equivalent number of Accreditation Units extra to the academic plan approved by the Operations Committee.

## **Extended Program**

An extension of Year One into the spring term allowing more time for the study of mathematics, chemistry and physics to assist first year students having difficulties in those subjects.

## **Faculty Board**

The Committee charged with overseeing all academic matters in the Faculty.

## **FEAS**

Faculty of Engineering and Applied Science.

## **GPA**

Grade Point Average - see Regulation 16a for definition.

## **H & SS**

Humanities and Social Sciences.

## **IAESTE**

International Association for the Exchange of Students for Technical Experience.

## **Internship**

A twelve or sixteen month period in industry, arranged by the University, for academic credit.

## **Letter of Permission**

A formal document allowing a student to take a course at another institution in lieu of one in the student's regular academic plan.

## **Natural Sciences**

Physics, Chemistry, Earth and Life Sciences.

## **Operations Committee**

A standing committee of Faculty Board which deals with Admissions, Scholarships, Academic Progress, and Curriculum matters.

## **P.Eng.**

Professional Engineer, registered by a Provincial licensing authority.

## **PEO**

Professional Engineers Ontario: The licensing authority in Ontario.

## **Prerequisites**

Courses which must be passed before the course in question can be taken.

## **Principal**

The Chief Executive Officer of the University.

## **Prior Learning Assessment (PLA)**

Challenge Examinations in First Year Subjects.

## **QUIP**

Queen's Undergraduate Internship Program.

## **Reading Week**

A period in which classes are suspended in favour of independent study.

## **Regular Session**

A Regular Session normally consists of the Fall, Winter and Summer terms of instruction. In the case of first year students registered in the Extended Program, the Regular Session includes the Spring term.

## **Regulations**

The rules established by the Faculty Board and by the Senate by which a student's academic progress and department are governed.

### **Reread**

The reassessment of a student's final paper in a course, on appeal.

### **SAL**

Student Assistance Levy.

### **Scholarship**

A financial award based on academic merit.

### **Senate**

The University's senior academic board.

### **SOLUS**

Student On-Line University System

### **Sub-plan**

One of two or more streams within an academic plan: eg., the Chemical Process Sub-plan in Chemical Engineering.

### **Substitution**

Replacement of a required course, stipulated in the calendar, by another course, with the approval of the Operations Committee.

### **SURP**

School of Urban and Regional Planning.

### **Term**

A period of instruction, usually of 12 weeks duration.

### **Transcript**

A document provided by the Registrar's Office that lists the entire academic record-to-date of a student in the University. An Official Transcript is certified by the Registrar.

### **Transfer Credit**

Credit allowed for a course taken in another Faculty or at another institution.

## Withdrawal

A formal process for discontinuing studies in a course or in an academic plan.

## Important Dates

Dates apply to the Fall-Winter academic year beginning in September 2019. See Sessional Dates for a complete list.

Registration	15-24 July	Course Selection on SOLUS Student Centre. Enrolment Appointment will appear in students SOLUS Student Centre beginning July 8th
	20 August	Time period to add and drop classes begins (Open Enrolment)
	1 Sept	Tuition payment for Fall term due
	10 January	Tuition payment for Winter term due
Orientation Week	31 Aug. - 4 Sept.	
Late Registration		<ul style="list-style-type: none"> <li>a. After 18 September, students must submit a written appeal for late registration to the Operations Committee. If the appeal is granted, the late fee will apply</li> <li>b. After 18 September (after Feb-winter term) no more registrations are accepted.</li> </ul>
Classes Begin and End	Fall: 5 Sept	Classes begin
	2 December	Classes end
	Winter: 6 January	Classes begin
	3 April	Classes end
	Summer (May-June session): 4 May	Classes begin

	24 June	Classes end
	Summer (May-July session): 4 May	Classes begin
	26 July	Classes end
	Summer (July-August session): 2 July	Classes begin
	10 August	Classes end
<b>Adding and Dropping Courses</b>		
Beginning 1 September, students can add and drop courses on SOLUS. The Chair of Undergraduate Studies in the specific academic plan must be advised when a course is dropped. Verbal requests to course instructors and/or absence from class are not sufficient and usually result in failure and loss of fee refund.		
Adding	18 September	Last date to add Fall Term courses and Fall-Winter courses.
	17 January	Last date to add Winter Term courses.
	8 May	Last date to add Summer Term (May-June and May-July session) courses.
	8 July	Last date to add Summer Term (July-August session) courses.
Dropping	Fall: 18 Sept	Last date to drop Fall Term courses without financial penalty
	Fall-Winter: 18 Sept	Last date to drop Fall-Winter courses without financial penalty
	Winter: 17 Jan	Last date to drop Winter Term courses without financial penalty
	Summer (May-June): 8 May	Last date to drop Summer Term (May-June) courses without financial penalty
	Summer (May-July): 15 May	Last date to drop Summer Term (May-July) courses without financial penalty



Complete Withdrawal from the University	18 September (January 17 for the winter term)	Last date to withdraw and obtain a full refund **
	17 January	Last date to withdraw from academic plan without failed year.
Student and Bus-It cards must be returned for full or partial refunds of student interest fees.		
Fall Term Break	24-25 October	
Reading Week	18-21 February	
	February (TBD)	Academic Plan Selection for First Year Students Deadline
Exam Dates	Fall: 4-19 December	
	Winter: 9-25 April	
	Summer (May-June): 20-21 June	
	Summer (May-July): 30 July-2 August	
	Summer (July-August): 14-15 August	
Convocation	Fall	TBA
	Spring	TBA
Pre-registration 2019	Get "Appointment Date" (pre-registration start date & time) from SOLUS beginning of July. Select courses on SOLUS from "Appointment Date" start date & time until end of pre-registration period.	

\*\* Information on late registration fees, refunds, and fees in general is provided in the Guide to Registration and Fees issued by the Registrar's Office. Fees information is also available at <http://queensu.ca/registrar/financials/tuition-fees>

<b>Dates for Extended Program for Section 900 Courses</b>		
13	January	Extended Program classes begin for Fall courses.
17	January	Last day to add a Fall Extended Program course.
24	January	Last day to drop a Fall Extended Program course.
18-21	February	Extended Program Fall course examinations.
24	February	Extended Program classes begin for Winter courses.
2	March	Last day to add/drop APSC 151 and/or APSC 162 rewrite examination.
28	February	Last day to drop a Regular Academic Plan Winter term course.
3	April	Last day to add a Winter Extended Program course (with permission of the Associate Dean-Academic)
6	April	Last day to drop a Winter Extended Program course.
1	May	Extended Program fees due.
4	May	Extended Program Spring term begins.
12	June	Extended Program classes end.
15-19	June	Extended Program Winter course examinations.

## **Sessional Dates**

**FEE DEADLINES:** Fee deadlines are not listed in the Sessional Dates, and do not necessarily correspond with academic deadlines. Information on deadlines for dropping courses without financial penalty is contained in the Guide to Registration and Fees available from the Office of the University Registrar on the web at <http://www.queensu.ca/registrar/currentstudents/fees.html>

**EXAMINATION REREADING DEADLINES:** The attention of students is drawn to Regulation 13 concerning deadlines for making application to reread examination papers.

## **April 2019**

29 Extended Program Spring Term begins

## **May 2019**

1 Summer Term begins

1 Tuition fees due in full for Summer Term classes (May-June/6W1 and May-July/12W Sessions).

1 Extended Program Fees are due

1 Last day for student consultations regarding Dual Degree in Economics application

6 Summer Term classes begin (May-June/6W1 and May-July/12W Sessions).

10 Last date to add Summer Term classes (May-June/6W1 and May-July/12W Sessions).

10 Last date to drop Summer Term classes (May-June/6W1 Session) without financial penalty.

10 Last date to apply for admission to the Upper-Year Program at Bader International Study Centre for Summer Term (August Session).

17 Last date to drop Summer Term classes (May-July/12W Session) without financial penalty.

17 Last day for eligible students in the regular First Year program to register to rewrite the exam for Winter First Year courses (APSC 112, APSC 132, APSC 172, and APSC 174)

20 Victoria Day (classes will not be held)

24 Last day to pay administrative fee for rewrite exams in Winter Term courses of the First Year program that are written in a location other than Kingston

31 Last date to drop Summer Term classes (May-June/6W1 Session) without academic penalty.

31 Last day to withdraw from rewrite exams for Winter Term First Year courses

## **June 2019**

NOTE: Spring 2020 Convocation dates will be published by the Office of the University Registrar in November 2019. Refer to <http://www.queensu.ca/registrar/convocation/ceremonies> to view these dates.

1 Last day to apply for Dual Degree Program for the next Fall-Winter session

7 Last date to apply for accommodation for an official examination conflict for the June, July and August examination sessions.

14 Extended Program classes end

14 Last day to apply for supplemental examination privileges

17 Summer Term classes end (May-June/6W1 Session).

17-21 Extended Program Winter course examinations

17-21 Summer Term examinations in May-June/6W1 Session classes (TENTATIVE).

28 Last date to drop Summer Term classes (May-July/12W Session) without academic penalty.

## **July 2019**

1 Tuition fees due in full for Summer Term classes (July-August/6W2 Session).

1 Canada Day observed (University closed. Classes will not be held).

2 Summer Term classes begin (July-August/6W2 Session).

8 Last date to add Summer Term classes (July-August/6W2 Session).

8 Last date to drop Summer Term classes (July-August/6W2 Session) without financial penalty.

15-24 Summer class selection period for Fall and Winter Term classes begins (TENTATIVE).

15 First day to apply to graduate for Fall 2019 Degree List (tentative).

26 Summer Term classes end (May-July/12W Session).

29 Last date to drop Summer Term classes (July-August/6W2 Session) without academic penalty.

30 Summer Term examinations in May-July/12W Session classes begin (TENTATIVE).

31 Last day to apply for admission to the upper-year courses at the Bader International Study Centre for Fall term.

31 Last day to apply for an Academic Plan Change (discipline change) for the Fall term

## **August 2019**

2 Summer class selection period for Fall and Winter Term classes ends (TENTATIVE)

2 Summer Term examinations in May-July/12W Session classes end (TENTATIVE)

5 Civic Holiday (University closed. Classes will not be held)

12 Summer Term classes end (July-August/6W2 session)

14-15 Summer Term examinations in July-August/6W2 Session classes (TENTATIVE)

15 Last day for late application for Academic Plan Change (discipline change) for the Fall term

16 Last day to cancel application for supplemental examinations without academic or financial penalty

27 Time period to add and drop classes (open enrolment period) begins (TENTATIVE)

31 Summer Term ends

31 Residence Move-in Day

31 Welcoming Ceremony for new students

31 Orientation Week begins (Arrival day)

## **September 2019**

1 Fall Term begins.

1 Tuition fees due in full for Fall Term classes - Exception: OSAP students

2 Labour Day (University closed. Classes will not be held)

3-4 Supplemental Examinations

5 Fall Term classes begin

7 Supplemental Examinations

13 Last date to apply for an academic plan change from one plan in Engineering to another plan in Engineering for the Fall term

18 Last date to:

- Drop Fall Term and Fall-Winter session course without financial penalty
- Register without extra fee. After this date, students must appeal in writing to the Operations Committee for permission to register late
- Add a Fall term course or a Fall-Winter sessional course
- Add a Fall term course or a Fall-Winter sessional course

30 Deadline for payment of residence, UHIP and student activity fees

30 Last day to apply to graduate for Fall 2019 Convocation

## **October 2019**

14 Thanksgiving Day (University closed. Classes will not be held)

16 University Day

24-25 Fall Term Break

## **November 2019**

NOTE: Fall 2019 Convocation: Dates will be determined in May 2019. Refer to <http://www.queensu.ca/registrar/convocation/ceremonies> to view these dates.

1 Last day to drop a Fall Term course without academic penalty

7 Last date to apply for accommodation for an official examination conflict for the December examination period.

11 Remembrance Day Service (Classes cancelled 10:30-11:30 a.m.)

15 Last date to apply for admission to the Upper-Year program at the Bader International Study Centre for Winter term.

29 Fall Term classes end.

30 Fall Term pre-examination study period begins

## **December 2019**

1 Last day to apply for admission to Dual Degree in Arts and Science for the next Winter Term

1 First day to apply to Graduate for Spring 2020 Degree List (tentative)

1 Last day to apply for an Academic Plan Change (discipline change) for the Winter term

2 Make-up day for Thanksgiving Monday (Engineering classes only)

3 Fall Term pre-examination study period ends

4-19 Fall Term examination period

6 Commemoration Day (All academic activity with the exception of clinical and field work will be cancelled)

15 Last day for late application for Academic Plan Change (discipline change) for the Winter term

31 Fall Term ends

## **January 2020**

1 Winter Term begins

1 New Year's Day (University closed. Classes will not be held)

6 Winter Term classes begin

10 Tuition Fees due in full for Winter term - Exception: OSAP students

10 Last date to apply for an academic plan change from one plan in Engineering to another plan in Engineering for the Winter term

10 Last day to apply for the exchange program for 2019-2020 (tentative)

13 Extended Program classes begin for APSC 111, APSC 131, and APSC 171

13 Last day to apply to rewrite a First Year Fall course examination (APSC 111, APSC 131, and APSC 171) which take place in February Reading Week

17 Last Date to:

- Drop a Winter Term course without financial penalty
- Add a Winter Term course
- Withdraw from degree program without failure of year

17 Last day to cancel an application to rewrite a First Year Fall course examination without academic penalty

17 Last day to add a Fall Extended Program course

21 Academic Plan (Discipline) Orientation for First Year Students begins

24 Last day to drop a Fall Extended Program course

## **February 2020**

TBA Last day to apply to graduate for Spring 2020 Degree List

3 Registration for Summer Term classes begins  
3 Academic Plan Selection for First Year Students begins on SOLUS (tentative)  
17 Family Day (University closed. Classes will not be held)  
18-21 Extended Program Fall course examinations  
18-21 Mid-Term Reading Week (Classes will not be held)  
24 Extended Program Classes begin for APSC 112, APSC 132, APSC 172, and APSC 174  
15 Last day of classes for Extended Program APSC 111, APSC 131, and APSC 171  
28 Last day to drop a Winter Term and multi-term classes without academic penalty  
TBA Academic Plan Selection for First Year Students ends on SOLUS

## **March 2020**

2 Last day to add/drop APSC 151 and/or APSC 161 rewrite examination in April  
7 Last date to apply for accommodation for an official examination conflict for the April examination period.  
30 Last day to apply for admission to upper year courses at the International Study Centre for Spring-Summer session

## **April 2020**

1 Last day to apply for admission to Dual Degree in Arts and Science for the Summer Term  
3 Winter term classes end  
3 Last date to add a Winter Extended program course (with permission of the Associate Dean-Academic)  
6 Last date to drop a Winter Extended program course  
4-8 Winter Term pre-examination study period  
9-25 Winter Term examination period  
10 Good Friday (University closed. Classes will not be held)  
30 Winter Term ends

## **May 2020**

1 Summer Term begins  
1 Tuition fees due in full for Summer Term classes - Exception: OSAP students

1 Extended Program Fees are due

4 Extended Program Spring Term begins

4 Summer Term classes begin (May-June/6W1 and May-July/12W Sessions).<sup>8</sup> Last date to drop Summer Term classes (May-June/6W1 Session) without financial penalty.

11 Summer Term Classes begin (May-June/6W1 and May-July/12W sessions)

15 Last date to add Summer Term classes (May-June/6W1 and May-July/12W Sessions).

15 Last day for eligible students in the regular First Year program to register to rewrite exams for Winter First Year courses (APSC 112, APSC 132, APSC 172, and APSC 174)

18 Victoria Day (University closed. Classes will not be held)

22 Last day to pay administrative fee for rewrite exams in Winter Term courses of the First Year program that are written in a location other than Kingston<sup>29</sup> Last day to withdraw from rewrite exams for Winter First Year courses

## **June 2020**

NOTE: Spring 2019 Convocation dates will be published by the Office of the University Registrar in November 2018. Refer to <http://www.queensu.ca/registrar/convocation/ceremonies> to view these dates.

1 Last day to apply for Dual Degree Program for the next Fall-Winter session

5 Last date to drop Summer Term classes (May-June/6W1 Session) without financial penalty.

5 Last date to drop Summer Term classes (May-June/6W1 Session) without academic penalty.

5 Last date to drop Summer Term classes (May-July/12W Session) without financial penalty.

12 Last day to apply for supplemental examination privileges

12 Extended Program classes end

15-19 Extended Program Winter course examinations

15 Summer Term classes end (May-June/6W1 Session).

18-19 Summer Term examinations in May-June/6W1 Session classes (TENTATIVE).

## **July 2020**

1 Canada Day (University closed. Classes will not be held)

1 Tuition fees due in full for Summer Term classes (July-August/6W2 Session) - Exception: OSAP students

2 Summer Term classes begin (July-August/6W2 Session).

3 Last date to drop Summer Term classes (May-July/12W session) without academic penalty

8 Last date to add Summer Term classes (July-August/6W2 Session).

8 Last date to drop Summer Term classes (July-August/6W2 Session) without financial penalty.



- 13-31 Summer class selection period for Fall and Winter Term classes (TENTATIVE)
- 15 First date to apply in SOLUS to graduate in Fall 2020 (TENTATIVE)
- 24 Summer Term classes (May-July session) end
- 29 Last date to drop Summer Term classes (July-August/6W2 Session) without academic penalty.
- 28-31 Summer Term examinations for May-July/12W Session classes begin (TENTATIVE).
- 31 Last date to apply for admission to the Upper-Year program at the Bader International Study Centre for Fall term.

## **August 2020**

- 3 Civic Holiday (University closed. Classes will not be held)
- 10 Summer Term classes end (July-August/6W2 Session).
- 12-13 Summer Term examinations in July-August/6W2 Session classes (TENTATIVE).
- 25 Time period to add and drop classes (open enrolment period) begins (Tentative)
- 31 Summer Term ends

## **September 2020**

- 1 Fall Term begins
- 1 Tuition fees due in full for Fall Term classes - Exception: OSAP students
- 5 Orientation Week begins (arrival day)
- 5 Welcoming Ceremony for new students
- 7 Labour Day (University closed. Classes will not be held)
- 10 Fall Term classes begin

**\*Please note:** Faith Dates are not included in the Academic Calendar. Please be aware of Faith Dates when coordinating any events in your department. For Faith Dates, please see the Human Rights web site at: <http://multifaithcalendar.org/cal/index.php>

## **Undergraduate Academic Plan**

### **Structure and Definitions**

The Faculty of Engineering and Applied Science offers degree programs in ten academic plans. Plans nominally of four years' duration lead to the degree of Bachelor of Applied Science in Engineering. Five-year plans, which include an Internship, lead to the degree of Bachelor of Applied Science in Engineering with Professional Internship. The codes for these plans and the prefix used throughout this Calendar for the courses in those disciplines are given below. **The First Year is common to all academic plans.**

<i>Program</i>	<i>Program Code</i>	<i>Course Prefix</i>
Chemical Engineering	CHEE	CHEE
Civil Engineering	CIVL	CIVL
Computer Engineering	CMPE	SOFT, CMPE or ELEC
Electrical Engineering	ELEC	ELEC
Engineering Chemistry	ENCH	ENCH
Engineering Physics	ENPH	ENPH
Geological Engineering	GEOE	GEOE
Mathematics and Engineering	MTHE	MTHE
Mechanical Engineering	MECH	MECH
Mining Engineering	MINE	MINE
Faculty Courses		APSC
Multi-department Courses		MDEP

There are five major components to each of these academic plans:

**MATHEMATICS:** Elements of algebra, calculus, differential equations, probability, statistics and numerical analysis;

**NATURAL SCIENCE:** Elements of Physics and Chemistry, and in some plans, elements of Earth and Life Sciences;

**COMPLEMENTARY STUDIES:** Topics in Engineering Economics, Communications, Management, Humanities and Social Sciences, Linkage and Professional Issues, and Performance Arts and Languages. Engineering Sciences and Engineering Design constitute about half of the plan in each case, with the other components approximately equal to each other in weight.

**ENGINEERING SCIENCE:** Extension of Mathematics and Basic Sciences toward creative applications;

**ENGINEERING DESIGN:** The application of Mathematics, Science, and Engineering Science to meet specific needs; and

**Program Accreditation and Licensing** The licensing of engineers in Canada is a provincial and territorial matter. Bodies such as Professional Engineers Ontario (PEO) are established by statute to govern the profession. The Canadian Council of Professional Engineers (CCPE) is the national federation of these governing bodies. A standing committee of CCPE, the Canadian Engineering Accreditation Board (CEAB), is responsible for identifying those educational programs that meet the academic standards required for membership in the profession. From time to time the Faculty of Engineering and Applied Science submits its academic plans to the CEAB for review. All of the academic plans in the Faculty of Engineering and Applied Science are accredited by the CEAB.

**Note:** Effective May 1, 2011, the Faculty of Engineering and Applied Science moved each course weight from accreditation units (AU) to credit units. This means, for example, that instead of a weighting of 36 AU, a course will now count as 3 credits. In order to determine the new credit weighting for each course, the AU was divided by 12 and, if needed, rounded to the nearest quarter (0.25, 0.50 or 0.75).

**Academic Plan and Course Symbols and Codes:** Plans are identified by a four-letter code (see table above). Courses are identified by:- a four letter code and a three digit number (the first of which identifies the year of the plan in which the course would normally be taken - i.e. 174 is a year one course); - a title; - a letter or letters indicating the term (F=Fall, W=Winter, FW=Fall **AND** Winter, F/W=Fall **OR** Winter, S=Summer, N/O=Not Offered);- a series of numbers indicating the units assigned to lectures (1 credit = one 50 minute lecture) and to laboratory assignments, tutorial, and significant project work (0.5 credits = one hour).

For example, the codes for a typical entry are:

- APSC 174 Introduction to Linear Algebra W | 3.3

*This is a Faculty course normally taken in the first year. It is offered in the Winter term, will have 36 fifty-minute lectures (3 lectures per week); no lab; twelve hours in tutorials (one hour per week). The final number is the sum of the accreditation units, and represents the weight of the course. A section on Course Descriptions appears elsewhere in this Calendar.*

**Requirements for Graduation** The minimum number of Accreditation Units required for graduation is stipulated for each of the academic plans in the Faculty. These minimum form part of the curriculum of each plan as described later in the Degree Program section of this Calendar. The minimum number varies from plan to plan, but in the current year all are greater than 1950 AU.

**Minimum Requirements for CEAB Accreditation**

The Canadian Engineering Accreditation Board (CEAB) requires all that all graduates from accredited engineering programs have Academic Units (AUs) at the time of graduation which meet ALL the following conditions 1-3:

1. Minimum AUs in the following five categories:

M	195AU	Mathematics
NS	195AU	Natural Science
CS	225AU	Complementary Studies
ES	225AU	Engineering Science
ED	225AU	Engineering Design

2. The sum of the AUs in these five categories shown above must be at least **1950 AUs**.
3. Two sums of categories must also meet minimum requirements as shown below e.g. the sum of AUs in Mathematics and Natural Sciences must be at least 420 AU, and the sum of AUs in Engineering Science and Engineering Design must be at least 900 AU:

M+NS	420AU	Mathematics(195 AUs or more) + Natural Science (195 AUs or more)
ES+ED	900AU	Engineering Science (225 AUs or more) + Engineering Design (225 AUs or more)

4. Within the broad five categories, it is expected that time will be spent on such topics as safety procedures, public and worker safety, ethics, equity, and concepts of sustainable development and of environmental stewardship.

The number of AUs in each of the five categories is listed at the end of each course description in the calendar (provide a link to the calendar). The AUs are listed in the format of (M/NS/CS/ES/ED). For example:

- MECH 230 Thermodynamics I F | 3.5

An introductory course in thermodynamics. Topics include: properties and behaviour of pure substances, concepts of heat, work and energy, the First and Second Laws of Thermodynamics, and the analysis of a variety of power and refrigeration cycles. (0/33/0/9/0)

The numbers in parentheses at the end of the course description are the AUs. This course has 0 Math AUs, 33 Natural Science AUs, 0 Complementary Studies AUs, 9 Engineering Science AUs, and 0 Engineering Design AUs.

*This course involves three lectures hours and one tutorial hour per week for the twelve weeks of the Fall term and therefore is assigned a weight of 3.5 credits which equates to 42 (AU) accreditation units. Of these, 33 units deal with topics in the Basic Sciences, and 9 are in Engineering Science. The course contains no Mathematics per se, no Complementary Studies, and no Engineering Design.*

### **APSC 199 English support for Engineers**

Students in all academic plans are required to demonstrate the ability to communicate effectively in written English. Within their first year, students registering in APSC 199 must attempt a written English proficiency test. Students who do not pass on the initial attempt will have further opportunities, and need to pass the test to meet the prerequisite for APSC 200, the second year design course. A student must pass APSC 199 to be eligible for graduation.

## **Dual Degrees**

Dual degrees are offered by the Faculty of Arts and Science can be taken concurrently with a degree in Engineering and Applied Science. Students must apply for admission through the Admission Services Office after one year at Queen's. To be accepted into a Dual Degree program in Engineering and Applied Science, you must have a minimum cumulative GPA of 2.60 or higher. The application deadline for summer term entry is **1 April**, fall term entry is **1 June** and for winter term entry is **1 December**. Candidates must have completed at least one year of study in their current academic plan and must be in good academic standing. Dual Degree programs will normally take at least one extra years of study, although some combinations of programs will be longer. Usually the path to be followed is intricate and requires the advisement of the Dual Degree Coordinator in the Engineering and Applied Science program. Dual Degree students share 60.0 units from their Engineering degree with their Arts and Science degree. Students must register in additional courses required for their 2nd degree and these additional courses must all be completed at Queen's. Fees for courses registered under the Arts and Science degree will be assessed according to the Faculty of Arts and Science. Further information can be found at <https://my.engineering.queensu.ca/Current-Students/dual-degrees>

## **Queen's University Internship Program (QUIP)**

The Professional Internship Program allows qualified students the opportunity to pursue career related positions for 12 or 16 months after completion of their second or third year of study at Queen's. (This program is available to students in all programs in the Faculty.)

Job openings under this program are posted online by Career Services. A student will have access once they register in the Internship Program.

In addition to the industrial experience for which the intern earns a salary, the Program includes prior workshops on resume preparation, interviewing, work performance, and employer expectations. Successful completion of the program requires submission of a formal report or presentation, and a satisfactory assessment of the intern's performance by the Employer. Up to twelve months of the work may meet the criteria for professional work experience required for licensure as a Professional Engineer in Canada.

The 12-month program requires registration in three courses, and the 16-month program requires registration in four courses - each course is 1-term in duration. These are: APSC 301 , APSC 302 , APSC 303 , and APSC 304 . There is a special academic fee for these courses. (See the section on Fees in this Calendar.)

Details on the Internship Program can be obtained from the Career Services Office in Gordon Hall, and from their website at <http://careers.queensu.ca/>. The Engineering and Applied Science Internship Coordinator is George Sweetman, [sweetmng@queensu.ca](mailto:sweetmng@queensu.ca).

## **University Exchange Programs**

The Faculty of Engineering and Applied Science offers student exchanges with other universities around the world. An exchange student can spend up to one year (one or two terms) at the host university in a program approved by the Department and the Operations Committee. In most instances the student can satisfy the requirements for graduation from Queen's in the usual four-year time frame. Details on these programs and a list of the host institutions can be found at <http://my.engineering.queensu.ca/Current-Students/Exchange-Programs/index.html>. Details on the IAESTE program can be obtained from the Queen's University International Centre, John Deutsch University Centre.

## **Non-academic Student Services and Resources**

Information on the services and resources available to students at Queen's, such as housing, medical services, and student activities, can be found on the Division of Student Affairs web page at <https://www.queensu.ca/studentaffairs/>, or the Faculty general web address at <http://engineering.queensu.ca/>. The services of the Engineering Society are listed at <http://engsoc.queensu.ca>.

## **First Year Studies**

### **First Year Studies, B.A.Sc.**

The first year of study in Engineering and Applied Science is based on a common curriculum and serves as an introduction to all of the academic plans offered by the Faculty. The choice of academic plan the student intends to follow in the second and subsequent years is made in February in the Winter Term of the first year.

## **Electrical and Computer Engineering Innovation (ECEi) Stream**

This program is intended for students with an interest in innovation and entrepreneurship who want to enter electrical or computer engineering in first year. The ECEi focuses on developing entrepreneurial skills alongside the technical and professional elements that are the hallmark of Queen's Engineering.

In the first year of the program students will take broad fundamental courses in math, science, and professional skills supplemented by an entrepreneurial design project specifically designed with for ECEi students. At the end of first year students choose between electrical or computer engineering, and develop strong technical fundamentals and skills necessary for innovation including economics and business practices, design and creativity, and teamwork.

Details about these streams are listed in the calendar at:

[https://calendar.engineering.queensu.ca/preview\\_program.php?catoid=8&poid=499&returnto=213](https://calendar.engineering.queensu.ca/preview_program.php?catoid=8&poid=499&returnto=213)

## **First Year Curriculum**

- APSC 100 Engineering Practice I FW | K9
- APSC 199 English Proficiency for Engineers FW, S | K0.2
  
- APSC 111 Physics I F | 3.3
- APSC 131 Chemistry and Materials F | 3.3
- APSC 143 Introduction to Computer Programming for Engineers F | 3.3

- APSC 151 Earth Systems Engineering F | 3.3
- APSC 171 Calculus I F | 3.3
- APSC 112 Physics II W | 3.3
- APSC 114 Electricity and Magnetism W | 3.3
- APSC 132 Chemistry and its Applications W | 3.3
- APSC 162 Engineering Graphics W | 2.5
- APSC 172 Calculus II W | 3.3
- APSC 174 Introduction to Linear Algebra W | 3.3
- APSC 182 Applied Engineering Mechanics W, F | 1.7

Minimum Total Credits: 43.1

## First Year Advice and Counseling

First Year students looking for academic advice and counseling are encouraged to contact the Program Associate, Student Services, Faculty of Engineering and Applied Science by phone at 533-2055 or by email at [engineering.first.year@queensu.ca](mailto:engineering.first.year@queensu.ca).

## The Douglas Help Desk

A gift from Dr. James Douglas (Queen's BA, 1858) in 1910 made possible the establishment of a program by which First Year students are tutored by students selected from senior years. Details are available in the Faculty Office, and on the web at <http://engineering.queensu.ca/Current-Students/First-Year-Studies/DouglasTutorials.html>

## The Engineering Society (EngSoc) Engvents

**The EngSoc Engvents** The Engvents Committee's mandate is to connect engineering students of all years and disciplines through team based competitions and social events hosted throughout the year. Past events have included paintballing, dodgeball tournaments, bowling nights, amazing race style scavenger hunts, and even a Boat Cruise on Lake Ontario! So come on out, connect with fellow engineers, and have a great time with Engvents! If you have any questions or would like to get involved with Engvents, contact [engvents@engsoc.queensu.ca](mailto:engvents@engsoc.queensu.ca).

## The Engineering Society (EngSoc) 'EngLinks' Tutoring System

For help using the EngSoc 'EngLinks' Tutoring System, see <http://englinks.ca/>

## The Extended Program

The Extended Program provides an opportunity for First Year students who experience difficulties with the introductory courses APSC 111, APSC 131, and/or APSC 171 in the fall semester to retake these courses in the winter semester. Registration in the Extended Program takes place in early January. The courses normally completed in December are reviewed, and final examinations are rewritten in February during Reading Week. Instruction in the second term courses in APSC 112, APSC 132, APSC 172 and APSC 174 begins after Reading Week, is suspended when regular Winter term lectures end, and resumes after the normal examination period. These second term courses are completed in June. There is a special fee for each course in the Spring term (see the Section on Fees) \*

## Orientation Nights

In late January and early February each department holds an Orientation Night for first year students to introduce them to the department and to its academic plan(s). Students are encouraged to attend as many of these evening seminars as possible to help them make their plan choice. Help in reaching a decision regarding future studies can also be obtained in private discussions with upper year students, instructors, and the Program Associate, Student Services in the Faculty Office. Help is available on web pages maintained the departments in the Faculty (see <http://engineering.queensu.ca/Current-Students/First-Year-Studies/DisciplineOrientationSchedule.html>).

## Choice of Program: Preregistration

First year students preregister in February to indicate the academic plan in which they intend to register in the academic year. A student will be admitted to the plan of their choice, provided the first year requirements have been met. Having preregistered in one plan, it may be possible to apply to transfer to another at a later date. However, such a change must be approved, in advance, by the department offering the academic plan in which the student wishes to register.

## Admission to a Second Year Program

The rules governing the admission to the second year are given in the Faculty Regulations Section: in particular, Regulations 2f, 2g, and 10. Briefly, if a student has passed all of the courses in the First Year plan with marks of 1.6 ECGPA or better, admission to the second year will be unconditional. Otherwise, there may be constraints. Advice should be sought from the Faculty Office, or from the Chair of Undergraduate Studies in the program of choice.

## Academic Plans

### Chemical Engineering

**Department Head** B. Amsden

**Undergraduate Chair** M. Guay

**Undergraduate Assistant** L.D. Joannette

**Office** Dupuis Hall, Room 205

**Telephone** (613) 533-6000 Ext. 74829

**E-mail** [undergrad@chee.queensu.ca](mailto:undergrad@chee.queensu.ca)

**Departmental Web Site** <http://www.chemeng.queensu.ca>

The Chemical Engineering academic plan provides students with a versatile engineering experience based on fundamental sciences, mathematics, and engineering science, combined with engineering design. Students may elect to pursue the Chemical Process Engineering Sub-plan (CHE1) or the Bioengineering - Biochemical, Biomedical, Bioenvironmental Sub-plan (CHE2). In addition to the technical content of the plan, students are introduced to business skills (engineering communication and ethics, innovation and entrepreneurship, process economics and project management) and acquire laboratory experience in state-of-the-art facilities. Group-based design projects are offered throughout the design spine. In their fourth year students select client-based industrial consulting projects, or research projects under the supervision of academic staff or professional engineers. All students have access to a computing facility, equipped with software programs and simulators.

### Ancillary Fees

Chemical Engineering and Engineering Chemistry students may be required to pay ancillary fees for course related learning materials, safety equipment and field trips.

**(CHE1) Chemical Engineering - Chemical Process Engineering Sub-Plan, B.A.Sc. (Class of 2020)**

## Second Year CORE 2017-2018

- CHEE 209 Analysis of Process Data F | 3.5
- CHEE 221 Chemical Processes and Systems F | 3.5
- CHEE 224 NOT OFFERED 2019-2020 Transport Phenomena Fundamentals F | 3
- ENCH 211 Main Group Chemistry F | 4.75
- ENCH 212 Principles of Chemical Reactivity F | 3.75
- MTHE 225 Ordinary Differential Equations F/W/S-OL | 3.5
- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- CHEE 210 Thermodynamics of Energy Conversion Systems W | 3.5
- CHEE 218 Laboratory Projects I W | 2.5
- CHEE 222 Process Dynamics and Numerical Methods W | 3.5
- CHEE 223 Fluid Mechanics W | 3.5
- ENCH 245 Applied Organic Chemistry I W | 4.75

Minimum Total Units: 44.25

## Third Year CORE 2018-2019

- CHEE 310 Deleted-Engineering Innovation and Entrepreneurship F | 3.5
- CHEE 311 Fluid Phase and Reaction Equilibrium F | 3.5
- CHEE 315 Laboratory Projects II F/W | 4
- CHEE 321 Chemical Reaction Engineering F | 3.5
- CHEE 330 Heat and Mass Transfer F | 3.5
- CHEE 380 Biochemical Engineering F | 3.5
- CHEE 319 Process Dynamics and Control W | 3.5
- CHEE 323 Industrial Catalysis w | 3.5
- CHEE 331 Design of Unit Operations w | K 4.5
- CHEE 361 Engineering Communications, Ethics & Professionalism W | K1
- CHEE 371 Mitigation of Industrial Pollution W | 3.5
- ELECTIVE Technical Elective (Minimum 3 Credits) F/W 3
- ELECTIVE Complementary Studies List A, B, C or D (3 Credits) F/W

Minimum Total Units: 43.5

## Fourth Year CORE 2019-2020

- CHEE 418 Strategies for Process Investigations F | 3.5
- CHEE 471 Chemical Process Design FW | K7
- CHEE 412 Transport Phenomena W | 3.5
- ELECTIVE Technical Elective (minimum 6 credits) F/W | 9
- ELECTIVE Complementary Studies List A, B, C or D (6 credits) F/W | 6

Plus One Of:



- APSC 400 Technology, Engineering & Management (TEAM) FW\* | 7 K7  
OR
- APSC 480 Multi-disciplinary Industry Engineering Design Project FW | K9  
OR
- CHEE 420 Laboratory Projects III F/W | K 4 Plus a TECH Elective from either Group A or Group B<sup>1</sup>  
OR
- CHEE 421 Research Project FW | K 7  
OR
- MINE 434 Project Report F/W | 4 Plus a TECH Elective from either Group A or Group B<sup>2</sup>

## Minimum Total Credits: 36

<sup>1</sup>*CHEE 420 and a TECH elective from either Group A or Group B count together as one choice.* This technical elective is counted separate from the technical elective requirements of the program.

<sup>2</sup>*MINE 434 and a TECH elective from either Group A or Group B count together as one choice.* This technical elective is counted separate from the technical elective requirements of the program.

## Technical Electives

Students in the CHE1 Process Engineering sub-plan (Class of 2020 only) must take a minimum total of twelve (12) credits in technical elective (TECH) courses of which a minimum of six (6) credits must be from the Technical Electives Group A list and the remaining six (6) credits from either the Technical Electives Group A or Technical Electives Group B list.

For students interested in a Minerals Processing/Metal Extraction focus the recommended course sequence is 1. MINE 267 (Winter term of 3rd year), 2. MINE 451 (Fall term of 4th year), and MINE 434 (Winter term of 4th year).

PLEASE NOTE: Some of these elective courses may not be available to students due to pre-requisite course requirements. The student is responsible for confirming that he/she has the necessary prerequisites or permission of the instructor.

PLEASE NOTE: Course availability and the term in which a course is held can change from one academic year to the next. This can occur due to instructor availability or a change to departmental resources. Please refer to SOLUS to find out if the TECH course is offered this upcoming year.

Chemical Process and Bioengineering Sub-plan: Technical Electives

## Complementary Studies

Students choose 9 credits from the approved Lists A, B, C, or D of which 6 credits must be taken from List A.

Refer to the Complementary Studies section of this calendar for details regarding the requirements for all Engineering plans.

## Engineering Economics

To meet the engineering economics requirement, students take CHEE 310 (this is a CORE course).

## Communications

To meet the communications course requirement, students take APSC 293 and CHEE 361 (these are CORE courses).

### **(CHE1) Chemical Engineering - Chemical Process Engineering Sub-Plan, B.A.Sc.(Class of 2021)**

#### **Second Year CORE 2018-2019**

- CHEE 209 Analysis of Process Data F | 3.5
- CHEE 221 Chemical Processes and Systems F | 3.5
- CHEE 224 NOT OFFERED 2019-2020 Transport Phenomena Fundamentals F | 3
- ENCH 211 Main Group Chemistry F | 4.75
- ENCH 212 Principles of Chemical Reactivity F | 3.75
- MTHE 225 Ordinary Differential Equations F/W/S-OL | 3.5
- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- CHEE 210 Thermodynamics of Energy Conversion Systems W | 3.5
- CHEE 218 Laboratory Projects I W | 2.5
- CHEE 222 Process Dynamics and Numerical Methods W | 3.5
- CHEE 223 Fluid Mechanics W | 3.5
- ENCH 245 Applied Organic Chemistry I W | 4.75

Minimum Total Units: 44.25

#### **Third Year CORE 2019-2020**

- APSC 221 Economics and Business Practices in Engineering F/W/S | 3
- CHEE 311 Fluid Phase and Reaction Equilibrium F | 3.5
- CHEE 315 Laboratory Projects II F/W | 4
- CHEE 321 Chemical Reaction Engineering F | 3.5
- CHEE 330 Heat and Mass Transfer F | 3.5
- CHEE 380 Biochemical Engineering F | 3.5
- CHEE 319 Process Dynamics and Control W | 3.5
- CHEE 323 Industrial Catalysis w | 3.5
- CHEE 331 Design of Unit Operations w | K 4.5
- CHEE 361 Engineering Communications, Ethics & Professionalism W | K1
- CHEE 371 Mitigation of Industrial Pollution W | 3.5
- Elective Complementary Studies List A, B, C or D (3 credits) F/W| 3
- Elective Technical Electives (min 3 credits) F/W| 3

Minimum Total Units: 43

NOTE: It is recommended that students take APSC 221 during the fall term in preparation for CHEE 331 in the winter term.

#### **Fourth Year CORE 2020-2021**

- CHEE 418 Strategies for Process Investigations F | 3.5
- CHEE 471 Chemical Process Design FW | K7

- CHEE 412 Transport Phenomena W | 3.5
- ELECTIVE Technical Elective (minimum 6 credits) F/W | 9
- ELECTIVE Complementary Studies List A, B, C or D (6 credits) F/W | 6

### Plus One Of:

- APSC 400 Technology, Engineering & Management (TEAM) FW\* | 7 K7  
OR
- APSC 480 Multi-disciplinary Industry Engineering Design Project FW | K9  
OR
- CHEE 410 NOT OFFERED 2019-2020 Engineering Innovation and Entrepreneurship W | K4  
Plus a TECH Elective from either Group A or Group B<sup>1</sup>  
OR
- CHEE 420 Laboratory Projects III F/W | K 4 Plus a TECH Elective from either Group A or Group B<sup>2</sup>  
OR
- CHEE 421 Research Project FW | K 7  
OR
- MINE 434 Project Report F/W | 4 Plus a TECH Elective from either Group A or Group B<sup>3</sup>

### Minimum Total Credits: 36

<sup>1</sup> CHEE 410 plus a TECH elective from either Group A or Group B count together as one choice. This technical elective is counted separate from the technical elective requirements of the program.

<sup>2</sup> CHEE 420 and a TECH elective from either Group A or Group B count together as one choice. This technical elective is counted separate from the technical elective requirements of the program.

<sup>3</sup> MINE 434 and a TECH elective from either Group A or Group B count together as one choice. This technical elective is counted separate from the technical elective requirements of the program.

### Technical Electives

Students in the CHE1 Process Engineering sub-plan (Class of 2021) must take four (4) technical elective (TECH) courses - two (2) technical elective courses from the Technical Electives Group A list and two (2) courses from either the Technical Electives Group A or Technical Electives Group B list.

For students interested in a Minerals Processing/Metal Extraction focus the recommended course sequence is 1. MINE 267 (Winter term of 3rd year), 2. MINE 451 (Fall term of 4th year), and MINE 434 (Winter term of 4th year).

PLEASE NOTE: Some of these elective courses may not be available to students due to pre-requisite course requirements. The student is responsible for confirming that he/she has the necessary prerequisites or permission of the instructor.

PLEASE NOTE: Course availability and the term in which a course is held can change from one academic year to the next. This can occur due to instructor availability or a change to departmental resources. Please refer to SOLUS to find out if the TECH course is offered this upcoming year.

Chemical Process and Bioengineering Sub-plan: Technical Electives

### Complementary Studies

Students choose 9 credits from the approved Lists A, B, C, or D of which 6 credits must be taken from List A.

Refer to the Complementary Studies section of this calendar for details regarding the requirements for all Engineering plans.

## Engineering Economics

To meet the engineering economics requirement, students take APSC 221 (this is a CORE course).

## Communications

To meet the communications course requirement, students take APSC 293 and CHEE 361 (these are CORE courses).

## **(CHE1) Chemical Engineering - Chemical Process Engineering Sub-Plan, B.A.Sc.(Class of 2022)**

### Second Year CORE 2019-2020

- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- CHEE 209 Analysis of Process Data F | 3.5
- CHEE 210 Thermodynamics of Energy Conversion Systems W | 3.5
- CHEE 218 Laboratory Projects I W | 2.5
- CHEE 221 Chemical Processes and Systems F | 3.5
- CHEE 222 Process Dynamics and Numerical Methods W | 3.5
- CHEE 223 Fluid Mechanics W | 3.5
- CHEE 224 NOT OFFERED 2019-2020 Transport Phenomena Fundamentals F | 3
- ENCH 211 Main Group Chemistry F | 4.75
- ENCH 212 Principles of Chemical Reactivity F | 3.75
- ENCH 245 Applied Organic Chemistry I W | 4.75
- MTHE 225 Ordinary Differential Equations F/W/S-OL | 3.5

### Minimum Total Credits: 45

NOTE: CHEE 224 will not be offered in 2019-2020. Students will instead take MTHE 227.

### Third Year CORE 2020-2021

- APSC 221 Economics and Business Practices in Engineering F/W/S | 3
- CHEE 311 Fluid Phase and Reaction Equilibrium F | 3.5
- CHEE 315 Laboratory Projects II F/W | 4
- CHEE 319 Process Dynamics and Control W | 3.5
- CHEE 321 Chemical Reaction Engineering F | 3.5
- CHEE 323 Industrial Catalysis w | 3.5
- CHEE 330 Heat and Mass Transfer F | 3.5
- CHEE 331 Design of Unit Operations w | K 4.5
- CHEE 361 Engineering Communications, Ethics & Professionalism W | K1
- CHEE 371 Mitigation of Industrial Pollution W | 3.5

- CHEE 380 Biochemical Engineering F | 3.5
- ELECTIVE Complementary Studies List A, B, C or D (3 Credits) F/W 3
- ELECTIVE Technical Elective (Minimum 3 Credits) F/W 3

### Minimum Total Credits: 43

NOTE: It is recommended that students take APSC 221 during the fall term in preparation for CHEE 331 in the winter term.

### Fourth Year CORE 2021-2022

- CHEE 412 Transport Phenomena W | 3.5
- CHEE 418 Strategies for Process Investigations F | 3.5
- CHEE 471 Chemical Process Design FW | K7
- Technical Elective (minimum 9 credits) F/W| 9
- Elective Complementary Studies List A, B, C, or D (6 credits) F/W| 6

### Plus One Of:

- APSC 400 Technology, Engineering & Management (TEAM) FW\* | 7 K7  
OR
- APSC 480 Multi-disciplinary Industry Engineering Design Project FW | K9  
OR
- CHEE 410 NOT OFFERED 2019-2020 Engineering Innovation and Entrepreneurship W | K4  
Plus a TECH Elective from either Group A or Group B<sup>1</sup>  
OR
- CHEE 420 Laboratory Projects III F/W | K 4 Plus a TECH Elective from either Group A or Group B<sup>2</sup>  
OR
- CHEE 421 Research Project FW | K 7  
OR
- MINE 434 Project Report F/W | 4 Plus a TECH Elective from either Group A or Group B<sup>3</sup>

### Minimum Total Credits: 36

<sup>1</sup> CHEE 410 plus a TECH elective from either Group A or Group B count together as one choice. This TECH elective is counted separate from the technical elective requirements of the program.

<sup>2</sup> CHEE 420 and a TECH elective from either Group A or Group B count together as one choice. This TECH elective is counted separate from the technical elective requirements of the program.

<sup>3</sup> MINE 434 and a TECH elective from either Group A or Group B count together as one choice. This TECH elective is counted separate from the technical elective requirements of the program.

### Technical Electives

Students in the CHE1 Process Engineering sub-plan (Class of 2022) must take four (4) technical elective (TECH) courses - two (2) technical elective courses from the Technical Electives Group A list and two (2) courses from either the Technical Electives Group A or Technical Electives Group B list.

For students interested in a Minerals Processing/Metal Extraction focus the recommended course sequence is 1. MINE 267 (Winter term of 3rd year), 2. MINE 451 (Fall term of 4th year), and MINE 434 (Winter term of 4th year).

PLEASE NOTE: Some of these elective courses may not be available to students due to pre-requisite course requirements. The student is responsible for confirming that he/she has the necessary prerequisites or permission of the instructor.

PLEASE NOTE: Course availability and the term in which a course is held can change from one academic year to the next. This can occur due to instructor availability or a change to departmental resources. Please refer to SOLUS to find out if the TECH course is offered this upcoming year.

Chemical Process and Bioengineering Sub-plan: Technical Electives

## Complementary Studies

Students choose 9 credits from the approved Lists A, B, C, or D of which 6 credits must be taken from List A.

Refer to the Complementary Studies section of this calendar for details regarding the requirements for all Engineering plans.

## Engineering Economics

To meet the engineering economics requirement, students take APSC 221 (this is a CORE course).

## Communications

To meet the communications course requirement, students take APSC 293 and CHEE 361 (these are CORE courses).

## **(CHE2) Bioengineering - Biochemical, Biomedical, Bioenvironmental Sub-Plan B.A.Sc. (2020)**

### Second Year CORE 2017-2018

- CHEE 209 Analysis of Process Data F | 3.5
- CHEE 221 Chemical Processes and Systems F | 3.5
- CHEE 229 Cell Based Engineering Principles F | 4
- ENCH 211 Main Group Chemistry F | 4.75
- ENCH 212 Principles of Chemical Reactivity F | 3.75
- MTHE 225 Ordinary Differential Equations F/W/S-OL | 3.5
- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- CHEE 210 Thermodynamics of Energy Conversion Systems W | 3.5
- CHEE 218 Laboratory Projects I W | 2.5
- CHEE 222 Process Dynamics and Numerical Methods W | 3.5
- CHEE 223 Fluid Mechanics W | 3.5
- ENCH 245 Applied Organic Chemistry I W | 4.75

Minimum Total Credits: 45.25

### Third Year CORE 2018-2019

- CHEE 310 Deleted-Engineering Innovation and Entrepreneurship F | 3.5
- CHEE 311 Fluid Phase and Reaction Equilibrium F | 3.5
- CHEE 321 Chemical Reaction Engineering F | 3.5
- CHEE 330 Heat and Mass Transfer F | 3.5
- CHEE 342 Environmental Biotechnology F | 3.5
- CHEE 380 Biochemical Engineering F | 3.5
- CHEE 315 Laboratory Projects II F/W | 4
- CHEE 319 Process Dynamics and Control W | 3.5
- CHEE 331 Design of Unit Operations w | K 4.5
- CHEE 340 Biomedical Engineering W | 3.5
- CHEE 361 Engineering Communications, Ethics & Professionalism W | K1
- CHEE 371 Mitigation of Industrial Pollution W | 3.5
- ELECTIVE Complementary Studies List A, B, C or D (3 Credits) F/W 3

Minimum Total Credits: 44

#### Fourth Year CORE 2019-2020

- CHEE 418 Strategies for Process Investigations F | 3.5
- CHEE 452 Transport Phenomena in Physiological Systems F | 3.5
- CHEE 471 Chemical Process Design FW | K7
- ELECTIVE Technical Elective (Minimum 9 Credits) F/W | 9
- ELECTIVE Complementary Studies, List A, B, C or D (6 Credits) F/W | 6

#### Plus One Of:

- APSC 400 Technology, Engineering & Management (TEAM) FW\* | 7 K7  
OR
- APSC 480 Multi-disciplinary Industry Engineering Design Project FW | K9  
OR
- CHEE 408 Bioengineering Research Project FW | K7  
OR
- CHEE 420 Laboratory Projects III F/W | K 4  
Plus a TECH elective from either Group A or Group B<sup>1</sup>

Minimum Total Credits: 36

<sup>1</sup> CHEE 420 and a TECH elective from either Group A or Group B count together as one choice. This technical elective is counted separate from the technical elective requirements of the program.

#### Technical Electives

Students in the CHE2 Bioengineering - Biochemical, Biomedical, Bioenvironmental sub-plan (Class of 2020) take one technical elective (TECH) course from the Technical Electives Group A list and two (2) courses from either the Technical Electives Group A or Technical Electives Group B technical electives list. NOTE: Students in the Bioengineering option are encouraged to select electives from the relevant elective groupings.

PLEASE NOTE: Some of these elective courses may not be available to students due to pre-requisite course requirements. The student is responsible for confirming that he/she has the necessary prerequisites or permission of the instructor.

PLEASE NOTE: Course availability and the term in which a course is held can change from one academic year to the next. This can occur due to instructor availability or a change to departmental resources. Please refer to SOLUS to find out if the TECH course is offered this upcoming year.

Chemical Process and Bioengineering Sub-plan: Technical Electives

## Complementary Studies

Students choose 9 credits from the approved Lists A, B, C, or D of which 6 credits must be taken from List A.

Refer to the Complementary Studies section of this calendar for details regarding the requirements for all Engineering plans.

## Engineering Economics

To meet the engineering economics requirement, students take CHEE 310 (this is a CORE course).

## Communications

To meet the communications course requirement, students take APSC 293 and CHEE 361 (these are CORE courses).

## **(CHE2) Bioengineering - Biochemical, Biomedical, Bioenvironmental Sub-Plan, B.A.Sc. (2021)**

### Second Year CORE 2018-2019

- CHEE 209 Analysis of Process Data F | 3.5
- CHEE 221 Chemical Processes and Systems F | 3.5
- CHEE 229 Cell Based Engineering Principles F | 4
- ENCH 211 Main Group Chemistry F | 4.75
- ENCH 212 Principles of Chemical Reactivity F | 3.75
- MTHE 225 Ordinary Differential Equations F/W/S-OL | 3.5
- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- CHEE 210 Thermodynamics of Energy Conversion Systems W | 3.5
- CHEE 218 Laboratory Projects I W | 2.5
- CHEE 222 Process Dynamics and Numerical Methods W | 3.5
- CHEE 223 Fluid Mechanics W | 3.5
- ENCH 245 Applied Organic Chemistry I W | 4.75

Minimum Total Credits: 45.25

### Third Year CORE 2019-2020

- APSC 221 Economics and Business Practices in Engineering F/W/S | 3



- CHEE 311 Fluid Phase and Reaction Equilibrium F | 3.5
- CHEE 321 Chemical Reaction Engineering F | 3.5
- CHEE 330 Heat and Mass Transfer F | 3.5
- CHEE 342 Environmental Biotechnology F | 3.5
- CHEE 380 Biochemical Engineering F | 3.5
- CHEE 315 Laboratory Projects II F/W | 4
- CHEE 319 Process Dynamics and Control W | 3.5
- CHEE 331 Design of Unit Operations w | K 4.5
- CHEE 340 Biomedical Engineering W | 3.5
- CHEE 361 Engineering Communications, Ethics & Professionalism W | K1
- CHEE 371 Mitigation of Industrial Pollution W | 3.5
- ELECTIVE Complementary Studies List A, B D or D (3 Credits) F/W | 3

Minimum Total Credits: 43.5

NOTE: It is recommended that students take APSC 221 during the fall term in preparation for CHEE 331 in the winter term.

#### Fourth Year CORE 2020-2021

- CHEE 418 Strategies for Process Investigations F | 3.5
- CHEE 452 Transport Phenomena in Physiological Systems F | 3.5
- CHEE 471 Chemical Process Design FW | K7
- ELECTIVE Technical Elective (Minimum 9 Credits) F/W | 9
- ELECTIVE Complementary Studies, List A, B, C or D (6 Credits) F/W | 6

#### Plus One Of:

- APSC 400 Technology, Engineering & Management (TEAM) FW\* | 7 K7  
OR
- APSC 480 Multi-disciplinary Industry Engineering Design Project FW | K9  
OR
- CHEE 408 Bioengineering Research Project FW | K7  
OR
- CHEE 410 NOT OFFERED 2019-2020 Engineering Innovation and Entrepreneurship W | K4  
PLUS a technical elective from either Group A or Group B<sup>1</sup>

Minimum Total Credits: 36

<sup>1</sup> CHEE 410 plus a technical elective from either Group A or Group B count together as one choice. This technical elective is counted separate from the technical elective requirements of the program.

#### Technical Electives

Students in the CHE2 Bioengineering - Biochemical, Biomedical, Bioenvironmental sub-plan (Class of 2021) take one technical elective (TECH) course from the Technical Electives Group A list and two (2) courses from either the

Technical Electives Group A or Technical Electives Group B technical electives list. NOTE: Students in the Bioengineering option are encouraged to select electives from the relevant elective groupings.

PLEASE NOTE: Some of these elective courses may not be available to students due to pre-requisite course requirements. The student is responsible for confirming that he/she has the necessary prerequisites or permission of the instructor.

PLEASE NOTE: Course availability and the term in which a course is held can change from one academic year to the next. This can occur due to instructor availability or a change to departmental resources. Please refer to SOLUS to find out if the TECH course is offered this upcoming year.

Chemical Process and Bioengineering Sub-plan: Technical Electives

## Complementary Studies

Students choose 9 credits from the approved Lists A, B, C, or D of which 6 credits must be taken from List A.

Refer to the Complementary Studies section of this calendar for details regarding the requirements for all Engineering plans.

## Engineering Economics

To meet the engineering economics requirement, students take APSC 221 (this is a CORE course).

## Communications

To meet the communications course requirement, students take APSC 293 and CHEE 361 (these are CORE courses).

## **(CHE2) Bioengineering - Biochemical, Biomedical, Bioenvironmental Sub-Plan, B.A.Sc. (2022)**

### Second Year CORE 2019-2020

- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- CHEE 209 Analysis of Process Data F | 3.5
- CHEE 210 Thermodynamics of Energy Conversion Systems W | 3.5
- CHEE 218 Laboratory Projects I W | 2.5
- CHEE 221 Chemical Processes and Systems F | 3.5
- CHEE 222 Process Dynamics and Numerical Methods W | 3.5
- CHEE 223 Fluid Mechanics W | 3.5
- CHEE 229 Cell Based Engineering Principles F | 4
- ENCH 211 Main Group Chemistry F | 4.75
- ENCH 212 Principles of Chemical Reactivity F | 3.75
- ENCH 245 Applied Organic Chemistry I W | 4.75
- MTHE 225 Ordinary Differential Equations F/W/S-OL | 3.5

Minimum Total Credits: 46

### Third Year CORE 2020-2021

- APSC 221 Economics and Business Practices in Engineering F/W/S | 3
- CHEE 311 Fluid Phase and Reaction Equilibrium F | 3.5
- CHEE 315 Laboratory Projects II F/W | 4
- CHEE 319 Process Dynamics and Control W | 3.5
- CHEE 321 Chemical Reaction Engineering F | 3.5
- CHEE 330 Heat and Mass Transfer F | 3.5
- CHEE 331 Design of Unit Operations w | K 4.5
- CHEE 342 Environmental Biotechnology F | 3.5
- CHEE 340 Biomedical Engineering W | 3.5
- CHEE 361 Engineering Communications, Ethics & Professionalism W | K1
- CHEE 371 Mitigation of Industrial Pollution W | 3.5
- CHEE 380 Biochemical Engineering F | 3.5
- ELECTIVE Complementary Studies List A, B D or D (3 Credits) F/W 3

Minimum Total Credits: 43.5

NOTE: It is recommended that students take APSC 221 during the fall term in preparation for CHEE 331 in the winter term.

#### Fourth Year CORE 2021-2022

- CHEE 418 Strategies for Process Investigations F | 3.5
- CHEE 452 Transport Phenomena in Physiological Systems F | 3.5
- CHEE 471 Chemical Process Design FW | K7
- ELECTIVE Technical Elective (Minimum 9 Credits) F/W | 9
- ELECTIVE Complementary Studies, List A, B, C or D (6 Credits) F/W | 6

#### Plus One Of:

- APSC 400 Technology, Engineering & Management (TEAM) FW\* | 7 K7  
OR
- APSC 480 Multi-disciplinary Industry Engineering Design Project FW | K9  
OR
- CHEE 408 Bioengineering Research Project FW | K7  
OR
- CHEE 410 NOT OFFERED 2019-2020 Engineering Innovation and Entrepreneurship W | K4  
PLUS technical elective from either Group A or Group B<sup>1</sup>

Minimum Total Credits: 36

<sup>1</sup> CHEE 410 plus a technical elective from either Group A or Group B count together as one choice. This technical elective is counted separate from the technical elective requirements of the program.

#### Technical Electives

Students in the CHE2 Bioengineering - Biochemical, Biomedical, Bioenvironmental sub-plan (Class of 2022) take one technical elective (TECH) course from the Technical Electives Group A list and two (2) courses from either the

Technical Electives Group A or Technical Electives Group B technical electives list. NOTE: Students in the Bioengineering option are encouraged to select electives from the relevant elective groupings.

PLEASE NOTE: Some of these elective courses may not be available to students due to pre-requisite course requirements. The student is responsible for confirming that he/she has the necessary prerequisites or permission of the instructor.

PLEASE NOTE: Course availability and the term in which a course is held can change from one academic year to the next. This can occur due to instructor availability or a change to departmental resources. Please refer to SOLUS to find out if the TECH course is offered this upcoming year.

Chemical Process and Bioengineering Sub-plan: Technical Electives

## Complementary Studies

Students choose 9 credits from the approved Lists A, B, C, or D of which 6 credits must be taken from List A.

Refer to the Complementary Studies section of this calendar for details regarding the requirements for all Engineering plans.

## Engineering Economics

To meet the engineering economics requirement, students take APSC 221 (this is a CORE course).

## Communications

To meet the communications course requirement, students take APSC 293 and CHEE 361 (these are CORE courses).

## Chemical Process and Bioengineering Sub-plan: Technical Electives

Should a course on the list below already be a core course for a sub-plan, then that course is excluded as an elective for that sub-plan. For example ...

- CHEE 340 and CHEE 342 are core courses for the CHE2 sub-plan and thus cannot be counted as electives.
- CHEE 323 is a core course for the CHE1 sub-plan and thus cannot be counted as an elective.
- APSC 250 has CHEE 229 as an exclusion (a core course taken by CHE2) and thus cannot be counted as an elective.

PLEASE NOTE: Some of these elective courses may not be available to students due to pre-requisite course requirements. The student is responsible for confirming that he/she has the necessary prerequisites or permission of the instructor.

PLEASE NOTE: Course availability and the term in which a course is held can change from one academic year to the next. This can occur due to instructor availability or a change to departmental resources. Please refer to SOLUS to find out if the TECH course is offered this upcoming year.

## Technical Electives Group A

### Biomedical

- CHEE 340 Biomedical Engineering W | 3.5

- CHEE 440 Pharmaceutical Technology W | 3.5
- MECH 393 Biomechanical Product Development F | 3.5
- MECH 478 Biomaterials F | 3.5
- MECH 492 Biological Fluid Dynamics F | 3.5

## Energy, Energy Resources, and Petroleum Engineering

- CHEE 270 ChemEtronics F | K3
- CHEE 363 Electrochemical Engineering\* W | 3.5
- CHEE 414 Foundations of the Oil and Gas Industry w | 3.5
- GEOE 418 Petroleum Geology F | 4.5
- MECH 430 NOT OFFERED 2019-2020 Thermal Systems Design W | 4
- MECH 435 Internal Combustion Engines W | 3.5
- MECH 437 Fuel Cell Technology F | 3.5
- MECH 439 Turbomachinery F | 3.5

## Engineering Design

- APSC 381 Advanced Design and Skills for Innovation W | K3.5

## Environmental

- CHEE 342 Environmental Biotechnology F | 3.5
- CHEE 484 NOT OFFERED 2019-2020 Bioremediation W | 3.5
- CIVL 371 Groundwater Engineering F | 3.75
- CIVL 372 Water and Wastewater Engineering W | 4
- CIVL 451 Lake, Reservoir and Coastal Engineering F | 3.75
- CIVL 471 Subsurface Contamination W | 4
- GEOE 343 NOT OFFERED THIS YEAR-Applied Hydrogeology F | 3.75

## Materials Processing

- CHEE 323 Industrial Catalysis w | 3.5
- CHEE 324 Organic Process Development W | 3.5
- CHEE 460 Applied Surface and Colloid Science F | 3.5
- CHEE 490 Polymer Formulations and Processing Technology W | 3.5
- MECH 270 Materials Science and Engineering F | 3.5
- MECH 370 Principles of Materials Processing F | 3.5
- MECH 371 Fracture Mechanics and Dislocation Theory W | 3.5
- MECH 476 Engineering of Polymers and Composite Materials W | 3.5
- MECH 478 Biomaterials F | 3.5

## Minerals Processing

- MINE 267 Applied Chemistry for Mining W | 3.5
- MINE 331 Methods of Mineral Separation F | 4.5

- MINE 335 Mineral Processing F | 3
- MINE 451 Chemical Extraction of Metals F | 3

## Process Automation, Applied Mathematics & Modeling

- CHEE 434 Process Control II W | 3.5
- ELEC 278 Fundamentals of Information Structures F | 4
- MECH 444 Computational Fluid Dynamics F | 3.5
- MECH 480 NOT OFFERED 2019-2020 - Airplane Aerodynamics and Performance W | 3.5

## General

- CHEE 421 Research Project FW | K 7

## Technical Electives Group B

### Applied Chemistry

- ENCH 213 Introduction to Chemical Analysis F | 4.5
- ENCH 222 Methods of Structure Determination W | 3.75
- ENCH 311 Mechanistic Organic Chemistry F | 3.5
- ENCH 312 Transition Metal Chemistry F | 3.5
- ENCH 326 Environmental and Green Chemistry W | 3
- ENCH 411 Advanced Analytical Chemistry F | 3
- ENCH 422 Synthetic Organic Chemistry W | 3.5
- ENCH 424 Polymer Chemistry W | 3

### Applied Mathematics & Statistics

- MTHE 339 Evolutionary Game Theory F | 3

### Biosciences

- APSC 250 Biology Through an Engineering Lens S/OL | K3.5
- BCHM 315 Proteins and Enzymes F | 3
- BIOL 205 Mendelian and Molecular Genetics F | 3
- BIOL 335 Limnology and Aquatic Ecology F | 3
- BIOM 300 NOT OFFERED 2019-2020 - Modeling Techniques in Biology F | 3
- ENCH 323 Biological Chemistry W | 3
- MBIO 218 NOT OFFERED THIS YEAR-Gene Structure and Function (Molecular Biology) W | 3.25

### Energy Resources/Petroleum Engineering

- GEOE 238 Surficial Processes, Sedimentation and Stratigraphy W | 4

### Civil Engineering

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**2nd Year Advisor** K. Genikomsou  
**3rd Year Advisor** A. Take  
**4th Year Advisor** Y. Fillion

Civil Engineering focuses on the analysis, design, and improvement of the human environment—both natural and constructed. Our students will learn how the world works and will provide improvements in the overall quality of life, make better use of limited resources, develop sustainable technologies, and create attractive and functional places to live and work.

Civil Engineering at Queen's University prepares students to identify emerging issues and develop innovative solutions to the numerous civil engineering, societal, and global challenges of the future.

The core undergraduate curriculum covers the key components of today's Civil Engineering professions. The study of environmental and sustainability issues is integrated throughout the academic plan to better reflect that the assessment of these concerns is integral to all civil engineering projects. The first three years of our plan provide broad-based training in: mathematics; science (physics, chemistry & geology); fluid, structural and soil mechanics; materials (water, concrete, steel, soil & plastics); and engineering problem solving & design. Students in their fourth year are able to either specialize in an area of interest, or further diversify their training. Specialization can be under the themes of buildings & structures, water & the environment, or geoenvironment. This student choice arises in the selection of: technical electives, topics for realistic design projects, areas to conduct advanced research, and practical industrial internships.

### **Civil Engineering, B.A.Sc. (Class of 2020)**

#### **Second Year CORE 2017-2018**

- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- CIVL 200 Professional Skills I F | K 2.5
- CIVL 210 Chemistry for Civil Engineers F | 4.5
- CIVL 230 Solid Mechanics I F | 4.25
- MTHE 224 Applied Mathematics for Civil Engineers F | 4.2
- Complementary Studies- Humanities & Social Sciences List A F | 3
- APSC 221 Economics and Business Practices in Engineering F/W/S | 3
- CIVL 215 Materials for Civil Engineers W | 4.5
- CIVL 222 Numerical Methods for Civil Engineers W | 5
- CIVL 231 Solid Mechanics II W | 4.5
- CIVL 250 Hydraulics I W | 4

**Minimum Total Credits: 44.45**

Note: A minimum of 6 credits must be taken from Complementary Studies List A.

#### **Third Year CORE 2018-2019**

- CIVL 300 Professional Skills II F | K 2.5
- CIVL 330 Structural Analysis F | 3.75
- CIVL 340 Geotechnical Engineering I F | 3.75
- CIVL 350 Hydraulics II F | 3.75
- CIVL 371 Groundwater Engineering F | 3.75
- Complementary Studies - Humanities & Social Sciences List A F | 3
- CIVL 331 Structural Steel Design W | 4
- CIVL 341 Geotechnical Engineering II W | 4
- CIVL 360 Civil Engineering Design and Practice III W | K4
- CIVL 372 Water and Wastewater Engineering W | 4
- Management Elective W | 3

Minimum Total Credits: 39.5

Note: A minimum of 6 credits must be taken from Complementary Studies List A.

#### Fourth Year CORE 2019-2020

- CIVL 400 Professional Skills III F | 2.5
- CIVL 460 Civil Engineering Design and Practice IV FW | K6
- Complementary Studies- List A, B, C, or D F | 3
- Electives F&W | 25.75

Minimum Credits: 37.25

#### Electives

All students must choose EIGHT Electives, **at least SIX of which must be Technical Electives from List 1 shown below.** The SEVENTH Elective may be from List 1 or List 2 shown below. The EIGHTH Elective may be from List 1 or List 2 or a Free Elective - see course list below.

Civil Engineering: Technical Electives

A Free Elective can be any of the following courses with a minimum of 3 credits

- Any 3 credit course appearing anywhere in the Applied Science calendar, in the course descriptions list, in the requirements for any academic plan, or in the lists of eligible complementary studies courses
- Any course at the 100 level or higher from the Arts and Science calendar with any of the following subject codes: ANAT, BCHM, BIOL, CDNS, CHEM, CISC, COGS, COMM, DEVS, GEOL, GIMS, GISC, GISQ, GPHY, HLTH, IDIS, INTS, ENSC, EPID, LING, MATH, MICR, PHAR, PHYS, PHGY, STSC, STAT, WRIT
- Any of the graduate courses offered in Urban and Regional Planning

Free Electives must be approved by the Undergraduate Chair, please contact the Undergraduate Program Assistant.

\*APSC 480: Units will not count towards the requirements of taking at least six Technical Electives from List 1 but because of the number of units, they will count towards a Technical Elective, List 2 or Free Elective.

**Civil Engineering, B.A.Sc. (Class of 2021)**



## Second Year CORE 2018-2019

- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- CIVL 200 Professional Skills I F | K 2.5
- CIVL 210 Chemistry for Civil Engineers F | 4.5
- CIVL 230 Solid Mechanics I F | 4.25
- MTHE 224 Applied Mathematics for Civil Engineers F | 4.2
- Complementary Studies- Humanities & Social Sciences List A F | 3
- APSC 221 Economics and Business Practices in Engineering F/W/S | 3
- CIVL 215 Materials for Civil Engineers W | 4.5
- CIVL 222 Numerical Methods for Civil Engineers W | 5
- CIVL 231 Solid Mechanics II W | 4.5
- CIVL 250 Hydraulics I W | 4

Minimum Credits: 44.45

Note: A minimum of 6 credits must be taken from Complementary Studies List A.

## Third Year CORE 2019-2020

- CIVL 300 Professional Skills II F | K 2.5
- CIVL 330 Structural Analysis F | 3.75
- CIVL 340 Geotechnical Engineering I F | 3.75
- CIVL 350 Hydraulics II F | 3.75
- CIVL 371 Groundwater Engineering F | 3.75
- Complementary Studies – Humanities & Social Sciences List A F | 3
- CIVL 331 Structural Steel Design W | 4
- CIVL 341 Geotechnical Engineering II W | 4
- CIVL 360 Civil Engineering Design and Practice III W | K4
- CIVL 372 Water and Wastewater Engineering W | 4
- Management Elective W | 3

Minimum Credits: 39.5

Note: A minimum of 6 credits must be taken from Complementary Studies List A.

## Fourth Year CORE 2020-2021

- CIVL 400 Professional Skills III F | 2.5
- CIVL 460 Civil Engineering Design and Practice IV FW | K6
- Complementary Studies- List A, B, C, or D F | 3
- Electives F&W | 28.75

Minimum Credits: 40.25

## Electives

All students must choose EIGHT Electives, **at least SIX of which must be Technical Electives from List 1 shown below**. The SEVENTH Elective may be from List 1 or List 2 shown below. The EIGHTH Elective may be from List 1 or List 2 or a Free Elective - see course list below.

Civil Engineering: Technical Electives

A Free Elective can be any of the following courses with a minimum of 3 credits:

- Any 3 credit course appearing anywhere in the Applied Science calendar, in the course descriptions list, in the requirements for any academic plan, or in the lists of eligible complementary studies courses
- Any course at the 100 level or higher from the Arts and Science calendar with any of the following subject codes: ANAT, BCHM, BIOL, CDNS, CHEM, CISC, COGS, COMM, DEVS, GEOL, GIMS, GISC, GISQ, GPHY, HLTH, IDIS, INTS, ENSC, EPID, LING, MATH, MICR, PHAR, PHYS, PHGY, STSC, STAT, WRIT
- Any of the graduate courses offered in Urban and Regional Planning

Free Electives must be approved by the Undergraduate Chair, please contact the Undergraduate Program Assistant.

\*APSC 480 : Units will not count towards the requirements of taking at least six Technical Electives from List 1 but because of the number of units, they will count towards a Technical Elective, List 2 or Free Elective.

### Civil Engineering, B.A.Sc. (Class of 2022)

#### Second Year CORE 2019-2020

- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 221 Economics and Business Practices in Engineering F/W/S | 3
- APSC 293 Engineering Communications I F/W | K1
- CIVL 200 Professional Skills I F | K 2.5
- CIVL 210 Chemistry for Civil Engineers F | 4.5
- CIVL 215 Materials for Civil Engineers W | 4.5
- CIVL 222 Numerical Methods for Civil Engineers W | 5
- CIVL 230 Solid Mechanics I F | 4.25
- CIVL 231 Solid Mechanics II W | 4.5
- CIVL 250 Hydraulics I W | 4
- MTHE 224 Applied Mathematics for Civil Engineers F | 4.2
- Complementary Studies - Humanities & Social Sciences List A F | 3

Minimum Total Credits: 44.45

Note: A minimum of 6 credits must be taken from Complementary Studies List A.

#### Third Year CORE 2020-2021

- CIVL 300 Professional Skills II F | K 2.5
- CIVL 330 Structural Analysis F | 3.75
- CIVL 340 Geotechnical Engineering I F | 3.75

- CIVL 350 Hydraulics II F | 3.75
- CIVL 371 Groundwater Engineering F | 3.75
- CIVL 331 Structural Steel Design W | 4
- CIVL 341 Geotechnical Engineering II W | 4
- CIVL 360 Civil Engineering Design and Practice III W | K4
- CIVL 372 Water and Wastewater Engineering W | 4
- Complementary Studies - Humanities & Social Sciences List A F | 3
- Management Elective W | 3

Minimum Total Credits: 39.5

Note: A minimum of 6 credits must be taken from Complementary Studies List A.

Fourth Year CORE 2021-2022

- CIVL 400 Professional Skills III F | 2.5
- CIVL 460 Civil Engineering Design and Practice IV FW | K6
- Complementary Studies - List A, B, C, or D F | 3
- Electives F&W 25.75

Minimum Total Credits: 37.25

## Electives

All students must choose EIGHT Electives, *at least SIX of which must be Technical Electives from List 1 shown below.* The SEVENTH Elective may be from List 1 or List 2 shown below. The **EIGHTH** Elective may be from List 1 or List 2 or a Free Elective - see course list below.

Civil Engineering: Technical Electives

A Free Elective can be any of the following courses with a minimum of 3 credits:

- Any 3 credit course appearing anywhere in the Applied Science calendar, in the course descriptions list, in the requirements for any academic plan, or in the lists of eligible complementary studies courses
- Any course at the 100 level or higher from the Arts and Science calendar with any of the following subject codes: ANAT, BCHM, BIOL, CDNS, CHEM, CISC, COGS, COMM, DEVS, GEOL, GIMS, GISC, GISQ, GPHY, HLTH, IDIS, INTS, ENSC, EPID, LING, MATH, MICR, PHAR, PHYS, PHGY, STSC, STAT, WRIT
- Any of the graduate courses offered in Urban and Regional Planning

Free Electives must be approved by the Undergraduate Chair, please contact the Undergraduate Program Assistant.

\*APSC 480: Units will not count towards the requirements of taking at least six Technical Electives from List 1 but because of the number of units, they will count towards a Technical Elective, List 2 or Free Elective.

## Civil Engineering: Technical Electives

### Technical Electives List 1

- CIVL 430 Reinforced Concrete Design F | 3.75
- CIVL 442 Geotechnical Design F | 3.75
- CIVL 450 Municipal Hydraulics F | 3.75
- CIVL 451 Lake, Reservoir and Coastal Engineering F | 3.75
- CIVL 473 Water Resources System W |
- CIVL 431 Infrastructure Rehabilitation W | 4
- CIVL 436 Prestressed Concrete W | 4
- CIVL 443 Geoenvironmental Design W | 4
- CIVL 455 River Engineering F | 4
- CIVL 471 Subsurface Contamination W | 4
- CIVL 500 Civil Engineering Thesis FW | K4

## Technical Electives List 2

- APSC 250 Biology Through an Engineering Lens S/OL | K3.5
- APSC 381 Advanced Design and Skills for Innovation W | K3.5
- APSC 480 Multi-disciplinary Industry Engineering Design Project FW | K9
- CHEE 302 Technical Entrepreneurship W/OL, F/OL, S/OL | K3.5
- CHEE 330 Heat and Mass Transfer F | 3.5
- CHEE 342 Environmental Biotechnology F | 3.5
- CHEE 371 Mitigation of Industrial Pollution W | 3.5
- CHEE 380 Biochemical Engineering F | 3.5
- CHEE 484 NOT OFFERED 2019-2020 Bioremediation W | 3.5
- GEOE 333 Terrain Evaluation W | 4
- GEOE 414 Foundations of the Oil and Gas Industry W | 3.5
- MECH 230 Thermodynamics I F | 3.5
- MECH 341 Fluid Mechanics II W | 3.5
- MECH 346 Heat Transfer W | 3.5
- MECH 371 Fracture Mechanics and Dislocation Theory W | 3.5
- MECH 394 Frontiers in Biomechanical Engineering W | 3.5
- MECH 424 Sustainable Product Design F | 3.5
- MECH 444 Computational Fluid Dynamics F | 3.5
- MECH 465 Computer-Aided Design F | 3.5
- MECH 495 Ergonomics and Design W | 3.5
- MINE 201 Introduction to Mining and Mineral Processing F | 4
- MINE 321 Drilling and Blasting F | 4.5
- MINE 324 Hydraulics for Mining Applications W | 3.5
- MINE 339 Mine Ventilation F | 4.5
- MINE 422 Mining and Sustainability F | 4
- MINE 459 Risk and Reliability Analysis for Industrial Asset Management, Health & Safety F | 4
- MINE 472 Mining Systems, Automation, and Robotics O/L | K3.5
- MNTC 313 Introduction to Programming O/L | 3
- MNTC 314 Drilling and Blasting O/L | 3
- MNTC 408 Mine Health and Safety O/L | 3
- MNTC 423 Geomatics O/L | 3
- SURP 855 Environmental Planning and Management W | 3
- SURP 853 Environmental Services W | 3

## Computer Engineering

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Computer Engineers deal with the architecture, design, implementation, and verification of the hardware and software for computing systems that are increasingly being used in embedded or networked environments. The Computer Engineering plan offers a broad range of supporting course material to prepare graduates for entry into the profession. In the hardware area, courses cover digital logic and digital systems engineering, computer organization and system architecture, microprocessors, and integrated circuit engineering. Software courses include programming languages, data structures and algorithms, operating systems, real-time software design, databases, compilers, software requirements analysis, formal methods in software engineering, and techniques for human-computer interaction. Computer communication network courses include material on reliable and secure information transfer protocols, switching and routing through multipath networks, and wireless networking.

The Computer Engineering plan is "streamed". Through choice of elective courses in third and fourth year, students can either focus their studies in one or more areas of specialization ("streams"), or pursue a broader coverage of the subject field. Streams are detailed on the Departmental web pages.

*First Year courses in Computer Science (APSC 142), Mathematics (APSC 171, APSC 172 and APSC 174), Engineering Practice (APSC 100) and Physics (APSC 112) form the basis for further study in Computer Engineering. Good performance is advisable for students planning to enter this academic plan.*

### Computer Engineering, B.A.Sc. (Class of 2020)

Elective courses in years three and four are to be chosen from Electives Lists A, B and C shown below (under Fourth Year), and by consulting suggested Streams and prerequisite paths. Your complete degree program must:

1. Exceed the minimum Accreditation Units (AU) set by ECE in each CEAB category.
2. Have at least 4 courses from combined Electives Lists B and C (but no more than 5 courses taken from List C can be counted towards fulfilling the degree program). Courses that qualify to be on Lists B and C will change yearly to reflect any instructor changes.
3. Have at least 5 four-hundred level elective courses.
4. Counting required core courses, plus elective courses chosen for second, third and fourth years, result in a total of no fewer than 116.5 credits for those years (remaining AU balance is shown below after each year).

Available combinations of elective courses are subject to timetabling constraints.

### Second Year CORE 2017-2018

- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- ELEC 221 Electric Circuits F | 4.25
- ELEC 271 Digital Systems F | 4
- ELEC 278 Fundamentals of Information Structures F | 4
- MTHE 235 Differential Equations for Electrical and Computer Engineers F | 3.5

- Complementary Studies, List A F | 3
- ELEC 252 Electronics I W | 4.25
- ELEC 270 Discrete Mathematics with Computer Engineering Applications W | 3.5
- ELEC 274 Computer Architecture W | 4
- ELEC 279 Introduction to Object Oriented Programming W | 4
- ELEC 280 Fundamentals of Electromagnetics W | 3.75
- ELEC 299 Mechatronics Project W | K1.5

Minimum Total Credits: 44.5

Remaining Credits Balance: 72

### Third Year CORE 2018-2019

- ELEC 371 Microprocessor Interfacing and Embedded Systems F | 4
- ELEC 377 Operating Systems F | 4
- CMPE 365 Algorithms I F | 4
- APSC 221 Economics and Business Practices in Engineering F/W/S | 3
- ELEC 326 Probability and Random Processes F | 3.5
- ELEC 373 Computer Networks W | 3.5
- ELEC 374 Digital Systems Engineering W | 4.25
- ELEC 390 Principles of Design and Development W | K3.5 \*
  
- CMPE 223 Software Specifications W | 3
- OR
- CMPE 320 Fundamentals of Software Development F | 4
  
- Electives Choose 2 electives from Electives Lists A or B or C (see lists under 4th year below) F/W | 6
- Complementary Studies List A F/W | 3

Total Credits: 40 or 41

Remaining Credits Balance: 32 or 31

\* with Departmental and instructor support, students may request to substitute APSC 381 and APSC 480 for ELEC 390 and ELEC 498

### Fourth Year CORE 2019-2020

- ELEC 498 Computer Engineering Project FW | K7 \*
- Electives: Choose a sufficient number of Electives from List A or B or C to fulfil the minimum program requirements in all CEAB categories F/W | 22 or 21
- Complementary Studies, List A, B, C or D F/W | 3

Minimum Total Credits: 32 or 31

## Remaining Credits Balance: 0

\* with Departmental and instructor support, students may request to substitute APSC 381 and APSC 480 for ELEC 390 and ELEC 498

## Electives

Computer Engineering: Electives

## Course Prerequisites

Normally, registration in a course offered by the Department is allowed provided a mark of at least D- has been achieved in each of the prerequisites for the course. Students having one course prerequisite (numbered 200 or higher) with a mark of FR may still be able to register in a course offered by the Department provided their Engineering Cumulative GPA is at least 2.0 at the end of the previous session. Prerequisites are listed under the calendar description for each course.

## Complementary Studies

Refer to the Complementary Studies section of this calendar for details regarding the requirements for all Engineering plans. For the Computer Engineering Plan, the Engineering Economics course is APSC 221, and the Communications course is APSC 293 (communications units are also included inside course ELEC 498).

## Computer Engineering, B.A.Sc. (Class of 2021)

Elective courses in years three and four are to be chosen from Electives Lists A, B and C shown below (under Fourth Year), and by consulting suggested Streams and prerequisite paths. Your complete degree program must:

1. Exceed the minimum Accreditation Units (AU) set by ECE in each CEAB category.
2. Have at least 4 courses from combined Electives Lists B and C (but no more than 5 courses taken from List C can be counted towards fulfilling the degree program). Courses that qualify to be on Lists B and C will change yearly to reflect any instructor changes.
3. Have at least 5 four-hundred level elective courses.
4. Counting required core courses, plus elective courses chosen for second, third and fourth years, result in a total of no fewer than 119.6 credits for those years (remaining AU balance is shown below after each year).

Available combinations of elective courses are subject to timetabling constraints.

## Second Year CORE 2018-2019

- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- ELEC 221 Electric Circuits F | 4.25
- ELEC 252 Electronics I W | 4.25
- ELEC 270 Discrete Mathematics with Computer Engineering Applications W | 3.5
- ELEC 271 Digital Systems F | 4
- ELEC 274 Computer Architecture W | 4
- ELEC 278 Fundamentals of Information Structures F | 4
- ELEC 279 Introduction to Object Oriented Programming W | 4
- ELEC 280 Fundamentals of Electromagnetics W | 3.75

- ELEC 299 Mechatronics Project W | K1.5
- MTHE 235 Differential Equations for Electrical and Computer Engineers F | 3.5
- Complementary Studies, List A F | 3

Total Credits: 44.5

Remaining Credits Balance: 75.1

### Third Year CORE 2019-2020

- APSC 221 Economics and Business Practices in Engineering F/W/S | 3
- CMPE 223 Software Specifications W | 3  
OR
- CMPE 320 Fundamentals of Software Development F | 4
- Electives Choose 2 electives from Electives Lists A or B or C (see lists under 4th year below) F/W | 6
- Complementary Studies List A F/W | 3
- CMPE 365 Algorithms I F | 4
- ELEC 326 Probability and Random Processes F | 3.5
- ELEC 371 Microprocessor Interfacing and Embedded Systems F | 4
- ELEC 373 Computer Networks W | 3.5
- ELEC 374 Digital Systems Engineering W | 4.25
- ELEC 377 Operating Systems F | 4
- ELEC 390 Principles of Design and Development W | K3.5 \*

Total Credits: 40 or 41

Remaining Credits Balance: 35.1 or 34.1

\* with Departmental and instructor support, students may request to substitute APSC 381 and APSC 480 for ELEC 390 and ELEC 498

### Fourth Year CORE 2020-2021

- ELEC 498 Computer Engineering Project FW | K7 \*
- Electives Choose a sufficient number of Electives from List A or B or C to fulfil the minimum program requirements in all CEAB categories F/W | 25.1 or 24.1
- Complementary Studies, List A, B, C or D F/W | 3

Minimum Total Credits: 35.1 or 34.1

Remaining Credits Balance: 0

\* with Departmental and instructor support, students may request to substitute APSC 381 and APSC 480 for ELEC 390 and ELEC 498



## Electives

Computer Engineering: Electives

## Course Prerequisites

Normally, registration in a course offered by the Department is allowed provided a mark of at least D- has been achieved in each of the prerequisites for the course. Students having one course prerequisite (numbered 200 or higher) with a mark of FR may still be able to register in a course offered by the Department provided their Engineering Cumulative GPA is at least 2.0 at the end of the previous session. Prerequisites are listed under the calendar description for each course.

## Complementary Studies

Refer to the Complementary Studies section of this calendar for details regarding the requirements for all Engineering plans. For the Computer Engineering Program, the Engineering Economics course is APSC 221, and the Communications course is APSC 293 (communications units are also included inside course ELEC 498).

## Computer Engineering, B.A.Sc. (Class of 2022)

Elective courses in years three and four are to be chosen from Electives Lists A, B and C shown below (under Fourth Year), and by consulting suggested Streams and prerequisite paths. Your complete degree program must:

1. Exceed the minimum Accreditation Units (AU) set by ECE in each CEAB category.
2. Have at least 4 courses from combined Electives Lists B and C (but no more than 5 courses taken from List C can be counted towards fulfilling the degree program). Courses that qualify to be on Lists B and C will change yearly to reflect any instructor changes.
3. Have at least 5 four-hundred level elective courses.
4. Counting required core courses, plus elective courses chosen for second, third and fourth years, result in a total of no fewer than 119.6 credits for those years (remaining AU balance is shown below after each year).

Available combinations of elective courses are subject to timetabling constraints.

## Second Year CORE 2019-2020

- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- ELEC 221 Electric Circuits F | 4.25
- ELEC 252 Electronics I W | 4.25
- ELEC 270 Discrete Mathematics with Computer Engineering Applications W | 3.5
- ELEC 271 Digital Systems F | 4
- ELEC 274 Computer Architecture W | 4
- ELEC 278 Fundamentals of Information Structures F | 4
- ELEC 279 Introduction to Object Oriented Programming W | 4
- ELEC 280 Fundamentals of Electromagnetics W | 3.75
- ELEC 299 Mechatronics Project W | K1.5
- MTHE 235 Differential Equations for Electrical and Computer Engineers F | 3.5
- Complementary Studies, List A F | 3

Total Credits: 44.5

Remaining Credits Balance: 75.1

### Third Year CORE 2020-2021

- APSC 221 Economics and Business Practices in Engineering F/W/S | 3
- CMPE 365 Algorithms I F | 4
- ELEC 326 Probability and Random Processes F | 3.5
- ELEC 371 Microprocessor Interfacing and Embedded Systems F | 4
- ELEC 373 Computer Networks W | 3.5
- ELEC 374 Digital Systems Engineering W | 4.25
- ELEC 377 Operating Systems F | 4
- ELEC 390 Principles of Design and Development W | K3.5 \*
- CMPE 223 Software Specifications W | 3
- OR
- CMPE 320 Fundamentals of Software Development F | 4
- Electives: Choose 2 electives from Electives Lists A or B or C (see lists under 4th year below) F/W 6
- Complementary Studies List A F/W 3

Total Credits: 40 or 41

Remaining Credits Balance: 35.1 or 34.1

\* with Departmental and instructor support, students may request to substitute APSC 381 and APSC 480 for ELEC 390 and ELEC 498

### Fourth Year CORE 2021-2022

- ELEC 498 Computer Engineering Project FW | K7 \*
- Electives: Choose a sufficient number of Electives from List A or B or C to fulfill the minimum program requirements in all CEAB categories F/W | 25.1 or 24.1
- Complementary Studies - List A, B, C, or D F/W 3

Minimum Total Credits: 35.1 or 34.1

Remaining Credits Balance: 0

\* with Departmental and instructor support, students may request to substitute APSC 381 and APSC 480 for ELEC 390 and ELEC 498

### Electives

Computer Engineering: Electives

### Course Prerequisites

Normally, registration in a course offered by the Department is allowed provided a mark of at least D- has been achieved in each of the prerequisites for the course. Students having one course prerequisite (numbered 200 or higher)

with a mark of FR may still be able to register in a course offered by the Department provided their Engineering Cumulative GPA is at least 2.0 at the end of the previous session. Prerequisites are listed under the calendar description for each course.

## Complementary Studies

Refer to the Complementary Studies section of this calendar for details regarding the requirements for all Engineering plans. For the Computer Engineering Program, the Engineering Economics course is APSC 221 , and the Communications course is APSC 293 (communications units are also included inside course ELEC 498 ).

### **Computer Engineering, ECEi Stream, B.A.Sc. (Class of 2020)**

Elective courses in years three and four are to be chosen from Electives Lists A, B and C shown below (under Fourth Year), and by consulting suggested Streams and prerequisite paths. Your complete degree program must:

- 1) Exceed the minimum Accreditation Units (AU) set by ECE in each CEAB category.
- 2) Have at least 4 courses from combined Electives Lists B and C (but no more than 5 courses taken from List C can be counted towards fulfilling the degree program). Courses that qualify to be on Lists B and C will change yearly to reflect any instructor changes.
- 3) Have at least 5 four-hundred level elective courses.
- 4) Counting required core courses, plus elective courses chosen for second, third and fourth years, result in a total of no fewer than 122.5 credits for those years (remaining AU balance is shown below after each year).

Available combinations of elective courses are subject to timetabling constraints.

## Second Year CORE 2017-2018

- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- COMM 201 Introduction to Business for Entrepreneurs F | 3
- ELEC 221 Electric Circuits F | 4.25
- ELEC 271 Digital Systems F | 4
- ELEC 278 Fundamentals of Information Structures F | 4
- MTHE 235 Differential Equations for Electrical and Computer Engineers F | 3.5
- Complementary Studies, List A F | 3
- ELEC 252 Electronics I W | 4.25
- ELEC 270 Discrete Mathematics with Computer Engineering Applications W | 3.5
- ELEC 274 Computer Architecture W | 4
- ELEC 279 Introduction to Object Oriented Programming W | 4
- ELEC 280 Fundamentals of Electromagnetics W | 3.75
- ELEC 299 Mechatronics Project W | K1.5

Minimum Total Credits: 47.5

Remaining Credits Balance: 75

## Third Year CORE 2018-2019

- COMM 301 Funding New Ventures F | 3
  - ELEC 371 Microprocessor Interfacing and Embedded Systems F | 4
  - ELEC 377 Operating Systems F | 4
  - CMPE 365 Algorithms I F | 4
  - ELEC 326 Probability and Random Processes F | 3.5
  - COMM 302 Launching New Ventures W | 3
  - ELEC 373 Computer Networks W | 3.5
  - ELEC 374 Digital Systems Engineering W | 4.25
  - ELEC 390 Principles of Design and Development W | K3.5 \*
- 
- CMPE 223 Software Specifications W | 3
- OR
- CMPE 320 Fundamentals of Software Development F | 4
  - Electives Choose 2 electives from Electives Lists A or B or C (see lists under 4th year below) F/W | 6
  - 1 of Complementary Studies List A F/W | 3

Minimum Total Credits: 43 or 44

Remaining Credits Balance: 32 or 31

\* with Departmental and instructor support, students may request to substitute APSC 381 and APSC 480 for ELEC 390 and ELEC 498

## Fourth Year CORE 2019-2020

- ELEC 498 Computer Engineering Project FW | K7 \*
- COMM 405 New Business Development F | 3
- Electives: Choose a sufficient number of Electives from List A or B or C to fulfill the minimum program requirements in all CEAB categories F/W | 22 or 21

Minimum Total Credits: 32 or 31

Remaining Credits Balance: 0

\* with Departmental and instructor support, students may request to substitute APSC 381 and APSC 480 for ELEC 390 and ELEC 498

## Electives

Computer Engineering: Electives

## Course Prerequisites

Normally, registration in a course offered by the Department is allowed provided a mark of at least D- has been achieved in each of the prerequisites for the course. Students having one course prerequisite (numbered 200 or higher)

with a mark of FR may still be able to register in a course offered by the Department provided their Engineering Cumulative GPA is at least 2.0 at the end of the previous session. Prerequisites are listed under the calendar description for each course.

## Complementary Studies

ECEi students are required to take a total of five Complementary Studies courses over 2nd, 3rd and 4th year: two elective Complementary Studies courses from List A (Humanities and Social Sciences) and the required three List B/D courses COMM 301, COMM 302 and COMM 405.

### **Computer Engineering, ECEi Stream, B.A.Sc. (Class of 2021)**

Elective courses in years three and four are to be chosen from Electives Lists A, B and C shown below (under Fourth Year), and by consulting suggested Streams and prerequisite paths. Your complete degree program must:

- 1) Exceed the minimum Accreditation Units (AU) set by ECE in each CEAB category.
- 2) Have at least 4 courses from combined Electives Lists B and C (but no more than 5 courses taken from List C can be counted towards fulfilling the degree program). Courses that qualify to be on Lists B and C will change yearly to reflect any instructor changes.
- 3) Have at least 5 four-hundred level elective courses.
- 4) Counting required core courses, plus elective courses chosen for second, third and fourth years, result in a total of no fewer than 125.6 credits for those years (remaining AU balance is shown below after each year).

Available combinations of elective courses are subject to timetabling constraints

## Second Year CORE 2018-2019

- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- COMM 201 Introduction to Business for Entrepreneurs F | 3
- ELEC 221 Electric Circuits F | 4.25
- ELEC 271 Digital Systems F | 4
- ELEC 278 Fundamentals of Information Structures F | 4
- MTHE 235 Differential Equations for Electrical and Computer Engineers F | 3.5
- Complementary Studies, List A F | 3
- ELEC 252 Electronics I W | 4.25
- ELEC 270 Discrete Mathematics with Computer Engineering Applications W | 3.5
- ELEC 274 Computer Architecture W | 4
- ELEC 279 Introduction to Object Oriented Programming W | 4
- ELEC 280 Fundamentals of Electromagnetics W | 3.75
- ELEC 299 Mechatronics Project W | K1.5

Minimum Total Credits: 47.5

Remaining Credits Balance: 78.1

## Third Year CORE 2018-2019

- COMM 301 Funding New Ventures F | 3
- ELEC 371 Microprocessor Interfacing and Embedded Systems F | 4
- ELEC 377 Operating Systems F | 4
- CMPE 365 Algorithms I F | 4
- ELEC 326 Probability and Random Processes F | 3.5
- COMM 302 Launching New Ventures W | 3
- ELEC 373 Computer Networks W | 3.5
- ELEC 374 Digital Systems Engineering W | 4.25
- ELEC 390 Principles of Design and Development W | K3.5 \*
  
- CMPE 223 Software Specifications W | 3
- OR
- CMPE 320 Fundamentals of Software Development F | 4
- Electives Choose 2 electives from Electives Lists A or B or C (see lists under 4th year below) F/W | 6
- 1 of Complementary Studies List A F/W | 3

Minimum Total Credits: 43 or 44

Remaining Credits Balance: 35.1 or 34.1

\* with Departmental and instructor support, students may request to substitute APSC 381 and APSC 480 for ELEC 390 and ELEC 498

## Fourth Year CORE 2020-2021

- ELEC 498 Computer Engineering Project FW | K7 \*
- COMM 405 New Business Development F | 3
- Electives: Choose a sufficient number of Electives from List A or B or C to fulfill the minimum program requirements in all CEAB categories F/W | 25.1 or 24.1

Minimum Total Credits: 35.1 or 34.1

Remaining Credits Balance: 0

\* with Departmental and instructor support, students may request to substitute APSC 381 and APSC 480 for ELEC 390 and ELEC 498

## Electives

Computer Engineering: Electives

## Course Prerequisites

Normally, registration in a course offered by the Department is allowed provided a mark of at least D- has been achieved in each of the prerequisites for the course. Students having one course prerequisite (numbered 200 or higher)

with a mark of FR may still be able to register in a course offered by the Department provided their Engineering Cumulative GPA is at least 2.0 at the end of the previous session. Prerequisites are listed under the calendar description for each course.

## Complementary Studies

ECEi students are required to take a total of five Complementary Studies courses over 2nd, 3rd and 4th year: two elective Complementary Studies courses from List A (Humanities and Social Sciences) and the required three List B/D courses COMM 301, COMM 302 and COMM 405.

### **Computer Engineering, ECEi Stream, B.A.Sc. (Class of 2022)**

Elective courses in years three and four are to be chosen from Electives Lists A, B and C shown below (under Fourth Year), and by consulting suggested Streams and prerequisite paths. Your complete degree program must:

- 1) Exceed the minimum Accreditation Units (AU) set by ECE in each CEAB category.
- 2) Have at least 4 courses from combined Electives Lists B and C (but no more than 5 courses taken from List C can be counted towards fulfilling the degree program). Courses that qualify to be on Lists B and C will change yearly to reflect any instructor changes.
- 3) Have at least 5 four-hundred level elective courses.
- 4) Counting required core courses, plus elective courses chosen for second, third and fourth years, result in a total of no fewer than 125.6 credits for those years (remaining AU balance is shown below after each year).

Available combinations of elective courses are subject to timetabling constraints

## Second Year CORE 2019-2020

- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- ELEC 221 Electric Circuits F | 4.25
- ELEC 252 Electronics I W | 4.25
- ELEC 270 Discrete Mathematics with Computer Engineering Applications W | 3.5
- ELEC 271 Digital Systems F | 4
- ELEC 274 Computer Architecture W | 4
- ELEC 278 Fundamentals of Information Structures F | 4
- ELEC 279 Introduction to Object Oriented Programming W | 4
- ELEC 280 Fundamentals of Electromagnetics W | 3.75
- ELEC 299 Mechatronics Project W | K1.5
- MTHE 235 Differential Equations for Electrical and Computer Engineers F | 3.5
- COMM 201 Introduction to Business for Entrepreneurs F | 3
- Complementary Studies, List A F/W | 3

Minimum Total Credits: 47.5

Remaining Credits Balance: 78.1

## Third Year CORE 2020-2021

- CMPE 365 Algorithms I F | 4
- ELEC 326 Probability and Random Processes F | 3.5
- ELEC 371 Microprocessor Interfacing and Embedded Systems F | 4
- ELEC 373 Computer Networks W | 3.5
- ELEC 374 Digital Systems Engineering W | 4.25
- ELEC 377 Operating Systems F | 4
- ELEC 390 Principles of Design and Development W | K3.5 \*
- CMPE 223 Software Specifications W | 3
- OR
- CMPE 320 Fundamentals of Software Development F | 4
- COMM 301 Funding New Ventures F | 3
- COMM 302 Launching New Ventures W | 3
- Electives: Choose 2 electives from Electives Lists A or B or C (see lists under 4th year below) F/W | 6
- Complementary Studies List A F/W | 3

Minimum Total Credits: 43 or 44

Remaining Credits Balance: 35.1 or 34.1

\* with Departmental and instructor support, students may request to substitute APSC 381 and APSC 480 for ELEC 390 and ELEC 498

## Fourth Year CORE 2021-2022

- ELEC 498 Computer Engineering Project FW | K7 \*
- COMM 405 New Business Development F | 3
- Electives: Choose a sufficient number of Electives from List A or B or C to fulfill the minimum program requirements in all CEAB categories F/W | 25.1 or 24.1

Minimum Total Credits: 35.1 or 34.1

Remaining Credits Balance: 0

\* with Departmental and instructor support, students may request to substitute APSC 381 and APSC 480 for ELEC 390 and ELEC 498

## Electives

Computer Engineering: Electives

## Course Prerequisites

Normally, registration in a course offered by the Department is allowed provided a mark of at least D- has been achieved in each of the prerequisites for the course. Students having one course prerequisite (numbered 200 or higher) with a mark of FR may still be able to register in a course offered by the Department provided their Engineering



Cumulative GPA is at least 2.0 at the end of the previous session. Prerequisites are listed under the calendar description for each course.

## Complementary Studies

ECEi students are required to take a total of five Complementary Studies courses over 2nd, 3rd and 4th year: two elective Complementary Studies courses from List A (Humanities and Social Sciences) and the required three List B/D courses COMM 301, COMM 302, COMM 405.

### Computer Engineering: Electives

#### Electives List A

- ELEC 323 Continuous-Time Signals and Systems F | 3.75
- ELEC 324 Discrete-Time Signals and Systems W | 4
- ELEC 344 Sensors and Actuators F | 3.75
- ELEC 353 Electronics II F | 4.25
- ELEC 408 Biomedical Signal and Image Processing W | 3
- ELEC 409 NOT OFFERED 2019-2020 Bioinformatic Analytics W | 3
- ELEC 421 Digital Signal Processing: Filters and System Design F | 4
- ELEC 422 NOT OFFERED 2019-2020 Digital Signal Processing: Random Models and Applications F | 3
- ELEC 425 Machine Learning and Deep Learning F | 3.5
- ELEC 431 Power Electronics F | 3.25
- ELEC 443 Linear Control Systems F | 4.25
- ELEC 444 NOT OFFERED 2019-2020 Modeling and Computer Control of Mechatronic Systems W | 3.25
  
- ELEC 448 Introduction to Robotics: Mechanics and Control W | 3.5  
OR
- MECH 456 NOT OFFERED 2019-2020 - Introduction to Robotics F | 3.5
  
- ELEC 451 Digital Integrated Circuit Engineering W | 3.25
- ELEC 461 NOT OFFERED 2019-2020 Digital Communications F | 3.5
- ELEC 464 Wireless Communications F | 3
- ELEC 470 NOT OFFERED 2019-2020 Computer System Architecture W | 3.5
- ELEC 472 Artificial Intelligence and Interactive Systems W | 3.5
- ELEC 474 Machine Vision F | 3.5
- ELEC 497 Research Project FW/S | K3.5
- ENPH 336 Solid State Devices W | 3.25
- ELEC 372 NOT OFFERED 2019-2020 Numerical Methods and Optimization W | 3.5

#### Electives List B

- CMPE 320 Fundamentals of Software Development F | 4
- CMPE 327 Software Quality Assurance F | 3
- CMPE 434 NOT OFFERED THIS YEAR: Distributed Systems F | 3
- CMPE 452 Neural Networks and Genetic Algorithms F | 3
- CMPE 457 Image Processing and Computer Vision F | 3

- CMPE 458 Programming Language Processors W | 4
- SOFT 437 NOT OFFERED 2019-2020 - Performance Analysis W | 3
- APSC 400 Technology, Engineering & Management (TEAM) FW\* | 7 K7

## Electives List C

- CMPE 204 Logic for Computing Science F/W | 3
- CMPE 322 Software Architecture F | 4
- CMPE 325 Human-Computer Interaction W | 3
- CMPE 332 Database Management Systems W | 3
- CMPE 422 Formal Methods in Software Engineering F | 3
- SOFT 423 Software Requirements W | 3
- CMPE 425 NOT OFFERED 2019-2020 Advanced User Interface Design W | 3
- CMPE 432 NOT OFFERED 2019-2020 Advanced Database Systems F | 3
- CMPE 454 Computer Graphics W | 3
- CMPE 251 Data Analytics F | 3
- CMPE 351 Advanced Data Analytics W | 3

## Electrical Engineering

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Electrical Engineers deal with telecommunications, computers, electronics, signal processing, robotics, biomedicine, transportation, industrial process control, electrical power generation and distribution, and design and operation of industrial machinery. The Electrical Engineering plan is intended to prepare graduates for entry into this broad discipline. Fundamental courses in electric and electronic circuits, electromagnetics, signals and systems, applied mathematics, and other topics in second and third year provide the basis for specialization in a number of areas through more advanced elective courses in signal processing, digital and wireless communication, control systems, electric machines, robotics, power electronics, microwave and optical communication systems, and integrated circuit engineering. The Electrical Engineering plan also incorporates core and elective courses in digital logic, computer systems, and software for additional breadth.

The Electrical Engineering plan is "streamed". Through choice of elective courses in third and fourth year, students can either focus their studies in one or more areas of specialization ("streams"), or pursue a broader coverage of the subject field. Streams are detailed on the Departmental web pages.

*First year courses in Mathematics (APSC 171, APSC 172, APSC 174), Physics (APSC 112), Engineering Practice (APSC 100) and Computing (APSC 142) form the basis for further study in Electrical Engineering. Good performance in these courses is advisable for students planning to enter this program.*

### Electrical Engineering, B.A.Sc. (Class of 2020)

Elective courses in years three and four are to be chosen from Electives Lists A and B (shown under fourth year), and by consulting suggested Streams and prerequisite paths. Your complete degree program must:

1. Exceed the minimum Accreditation Units (AU) set by ECE in each CEAB category.
2. Have at least 5 courses from Electives List A.
3. Have at least 5 four-hundred level elective courses.
4. Counting required core courses, plus elective courses chosen for second, third and fourth year, result in a total of no fewer than 116.5 credits for those years (remaining AU balance is shown below after each year).

Available combinations of elective courses are subject to timetabling constraints.

## Second Year CORE 2017-2018

- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- ELEC 221 Electric Circuits F | 4.25
- ELEC 252 Electronics I W | 4.25
- ELEC 271 Digital Systems F | 4
- ELEC 273 NOT OFFERED 2019-2020 Numerical Methods and Optimization W | 3.5
- ELEC 274 Computer Architecture W | 4
- ELEC 278 Fundamentals of Information Structures F | 4
- ELEC 280 Fundamentals of Electromagnetics W | 3.75
- ELEC 299 Mechatronics Project W | K1.5
- MTHE 228 Complex Analysis W | 3.5
- MTHE 235 Differential Equations for Electrical and Computer Engineers F | 3.5
- Complementary Studies, List A F | 3

Minimum Total Credits: 44

Remaining Credits Balance: 72.50

## Third Year CORE 2018-2019

- APSC 221 Economics and Business Practices in Engineering F/W/S | 3
- ELEC 323 Continuous-Time Signals and Systems F | 3.75
- ELEC 324 Discrete-Time Signals and Systems W | 4
- ELEC 326 Probability and Random Processes F | 3.5
- ELEC 353 Electronics II F | 4.25
- ELEC 371 Microprocessor Interfacing and Embedded Systems F | 4
- ELEC 381 Applications of Electromagnetics F | 3.75
- ELEC 390 Principles of Design and Development W | K3.5 \*
- ENPH 336 Solid State Devices W | 3.25
- Choose 2 electives from Electives Lists A or B (see lists under 4th year below) | 6
- 1 of Complementary Studies List A F/W | 3

Minimum Total Credits: 40.75

Remaining Credits Balance: 31.75

\* with Departmental and instructor support, students may request to substitute APSC 381 and APSC 480 for ELEC 390 and ELEC 490

## Fourth Year CORE 2019-2020

- ELEC 490 Electrical Engineering Project FW | K7 \*
- Complementary Studies, List A, B, C or D F/W | 3
- Electives F/W | 21.75

Total Credits: 31.75

Remaining Credits Balance: 0

\* with Departmental and instructor support, students may request to substitute APSC 381 and APSC 480 for ELEC 390 and ELEC 490

## Electives

Electrical Engineering: Electives

## Course Prerequisites

Normally, registration in a course offered by the ECE Department is allowed provided a mark of at least D- has been achieved in each of the prerequisites for the course. Students having one course prerequisite (numbered 200 or higher) with a mark of FR may still be able to register in a course offered by the Department provided their Engineering Cumulative GPA is at least 2.0 at the end of the previous session. Prerequisites are listed under the calendar description for each course.

## Complementary Studies

Refer to the Complementary Studies section of this calendar for details regarding the requirements for all Engineering plans. For the Electrical Engineering Plan, the Engineering Economics course is APSC 221, and the Communications course is APSC 293 (1 credit of communications units are also included in course ELEC 490).

## Electrical Engineering, B.A.Sc. (Class of 2021)

Elective courses in years three and four are to be chosen from Electives Lists A and B (shown under fourth year), and by consulting suggested Streams and prerequisite paths. Your complete degree program must:

1. Exceed the minimum Accreditation Units (AU) set by ECE in each CEAB category.
2. Have at least 5 courses from Electives List A.
3. Have at least 5 four-hundred level elective courses.
4. Counting required core courses, plus elective courses chosen for second, third and fourth years, result in a total of no fewer than 119.6 credits for those years (remaining AU balance is shown below after each year).

Available combinations of elective courses are subject to timetabling constraints.

## Second Year CORE 2018-2019

- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- ELEC 221 Electric Circuits F | 4.25

- ELEC 252 Electronics I W | 4.25
- ELEC 271 Digital Systems F | 4
- ELEC 278 Fundamentals of Information Structures F | 4
- ELEC 273 NOT OFFERED 2019-2020 Numerical Methods and Optimization W | 3.5
- ELEC 274 Computer Architecture W | 4
- ELEC 280 Fundamentals of Electromagnetics W | 3.75
- ELEC 299 Mechatronics Project W | K1.5
- MTHE 228 Complex Analysis W | 3.5
- MTHE 235 Differential Equations for Electrical and Computer Engineers F | 3.5
- Complementary Studies, List A F | 3-0-0 | 3

Minimum Total Credits: 44

Remaining Credits Balance: 75.60

### Third Year CORE 2019-2020

- APSC 221 Economics and Business Practices in Engineering F/W/S | 3
- ELEC 323 Continuous-Time Signals and Systems F | 3.75
- ELEC 324 Discrete-Time Signals and Systems W | 4
- ELEC 326 Probability and Random Processes F | 3.5
- ENPH 336 Solid State Devices W | 3.25
- Choose 2 electives from Electives Lists A or B (see lists under 4th year below) | 6
- Complementary Studies List A F/W | 3
- ELEC 353 Electronics II F | 4.25
- ELEC 371 Microprocessor Interfacing and Embedded Systems F | 4
- ELEC 381 Applications of Electromagnetics F | 3.75
- ELEC 390 Principles of Design and Development W | K3.5 \*

Minimum Total Credits: 40.75

Remaining Credits Balance: 34.85

\* with Departmental and instructor support, students may request to substitute APSC 381 and APSC 480 for ELEC 390 and ELEC 490

### Fourth Year CORE 2020-2021

- ELEC 490 Electrical Engineering Project FW | K7 \*
- Complementary Studies, List A, B, C or D F/W | 3
- Electives F/W | 24.85

Total Credits: 34.85

Remaining Credits Balance: 0

\* with Departmental and instructor support, students may request to substitute APSC 381 and APSC 480 for ELEC 390 and ELEC 490

## Electives

Electrical Engineering: Electives

## Course Prerequisites

Normally, registration in a course offered by the ECE Department is allowed provided a mark of at least D- has been achieved in each of the prerequisites for the course. Students having one course prerequisite (numbered 200 or higher) with a mark of FR may still be able to register in a course offered by the Department provided their Engineering Cumulative GPA is at least 2.0 at the end of the previous session. Prerequisites are listed under the calendar description for each course.

## Complementary Studies

Refer to the Complementary Studies section of this calendar for details regarding the requirements for all Engineering plans. For the Electrical Engineering Plan, the Engineering Economics course is APSC 221, and the Communications course is APSC 293 (1 credit of communications units are also included in course ELEC 490).

## Electrical Engineering, B.A.Sc. (Class of 2022)

Elective courses in years three and four are to be chosen from Electives Lists A and B (shown under fourth year), and by consulting suggested Streams and prerequisite paths. Your complete degree program must:

1. Exceed the minimum Accreditation Units (AU) set by ECE in each CEAB category.
2. Have at least 5 courses from Electives List A.
3. Have at least 5 four-hundred level elective courses.
4. Counting required core courses, plus elective courses chosen for second, third and fourth years, result in a total of no fewer than 119.6 credits for those years (remaining AU balance is shown below after each year).

Available combinations of elective courses are subject to timetabling constraints.

## Second Year CORE 2019-2020

- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- ELEC 221 Electric Circuits F | 4.25
- ELEC 224 Continuous-Time Signals and Systems W | 3.75
- ELEC 252 Electronics I W | 4.25
- ELEC 271 Digital Systems F | 4
- ELEC 274 Computer Architecture W | 4
- ELEC 278 Fundamentals of Information Structures F | 4
- ELEC 280 Fundamentals of Electromagnetics W | 3.75
- ELEC 299 Mechatronics Project W | K1.5
- MTHE 228 Complex Analysis W | 3.5
- MTHE 235 Differential Equations for Electrical and Computer Engineers F | 3.5
- Complementary Studies - List A F | 3

Minimum Total Credits: 44.25

Remaining Credits Balance: 75.35

### Third Year CORE 2020-2021

- APSC 221 Economics and Business Practices in Engineering F/W/S | 3
- ELEC 324 ELEC 324 Discrete-Time Signals and Systems F | 4
- ELEC 326 Probability and Random Processes F | 3.5
- ENPH 336 Solid State Devices W | 3.25
- Choose 2 electives from Electives Lists A or B (see lists under 4th year below) | 6
- Complementary Studies List A F/W | 3
- ELEC 353 Electronics II F | 4.25
- ELEC 371 Microprocessor Interfacing and Embedded Systems F | 4
- ELEC 372 NOT OFFERED 2019-2020 Numerical Methods and Optimization W | 3.5
- ELEC 381 Applications of Electromagnetics F | 3.75
- ELEC 390 Principles of Design and Development W | K3.5 \*

Minimum Total Credits: 40.5

Remaining Credits Balance: 34.85

\* with Departmental and instructor support, students may request to substitute APSC 381 and APSC 480 for ELEC 390 and ELEC 490

### Fourth Year CORE 2021-2022

- ELEC 490 Electrical Engineering Project FW | K7 \*
- Complementary Studies, List A, B, C or D F/W | 3
- Electives F/W | 24.85

Minimum Total Credits: 34.85

Remaining Credits Balance: 0

\* with Departmental and instructor support, students may request to substitute APSC 381 and APSC 480 for ELEC 390 and ELEC 490

### Electives

Electrical Engineering: Electives

### Course Prerequisites

Normally, registration in a course offered by the ECE Department is allowed provided a mark of at least D- has been achieved in each of the prerequisites for the course. Students having one course prerequisite (numbered 200 or higher)

with a mark of FR may still be able to register in a course offered by the Department provided their Engineering Cumulative GPA is at least 2.0 at the end of the previous session. Prerequisites are listed under the calendar description for each course.

## Complementary Studies

Refer to the Complementary Studies section of this calendar for details regarding the requirements for all Engineering plans. For the Electrical Engineering Plan, the Engineering Economics course is APSC 221, and the Communications course is APSC 293 (1 credit of communications units are also included in course ELEC 490).

### **Electrical Engineering, ECEi Stream, B.A.Sc. (Class of 2020)**

Elective courses in years three and four are to be chosen from Electives Lists A and B (shown under fourth year), and by consulting suggested Streams and prerequisite paths. Your complete degree program must:

- 1) Exceed the minimum Accreditation Units (AU) set by ECE in each CEAB category.
- 2) Have at least 5 courses from Electives List A.
- 3) Have at least 5 four-hundred level elective courses.
- 4) Counting required core courses, plus elective courses chosen for second, third and fourth years, result in a total of no fewer than 122.5 credits for those years (remaining AU balance is shown below after each year).

Available combinations of elective courses are subject to timetabling constraints.

### Second Year CORE 2017-2018

- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- COMM 201 Introduction to Business for Entrepreneurs F | 3
- ELEC 221 Electric Circuits F | 4.25
- ELEC 252 Electronics I W | 4.25
- ELEC 271 Digital Systems F | 4
- ELEC 278 Fundamentals of Information Structures F | 4
- ELEC 273 NOT OFFERED 2019-2020 Numerical Methods and Optimization W | 3.5
- ELEC 274 Computer Architecture W | 4
- ELEC 280 Fundamentals of Electromagnetics W | 3.75
- ELEC 299 Mechatronics Project W | K1.5
- MTHE 228 Complex Analysis W | 3.5
- MTHE 235 Differential Equations for Electrical and Computer Engineers F | 3.5
- Complementary Studies, List A F/W | 3

Minimum Total Credits: 47

Remaining Credits Balance: 75.5

### Third Year CORE 2018-2019



- COMM 301 Funding New Ventures F | 3
- ELEC 323 Continuous-Time Signals and Systems F | 3.75
- ELEC 324 Discrete-Time Signals and Systems W | 4
- ELEC 326 Probability and Random Processes F | 3.5
- COMM 302 Launching New Ventures W | 3
- ELEC 353 Electronics II F | 4.25
- ELEC 371 Microprocessor Interfacing and Embedded Systems F | 4
- ELEC 381 Applications of Electromagnetics F | 3.75
- ELEC 390 Principles of Design and Development W | K3.5 \*
- ENPH 336 Solid State Devices W | 3.25
- 2 Electives List A or B F/W | 6
- 1 Complementary Studies List A F/W | 3

Minimum Total Credits: 43.75

Remaining Credits Balance: 31.75

\* with Departmental and instructor support, students may request to substitute APSC 381 and APSC 480 for ELEC 390 and ELEC 490

#### Fourth Year CORE 2019-2020

- ELEC 490 Electrical Engineering Project FW | K7
- COMM 405 New Business Development F | 3
- Electives F/W | 21.75

Minimum Total Credits: 31.75

Remaining Credits Balance: 0

\* with Departmental and instructor support, students may request to substitute APSC 381 and APSC 480 for ELEC 390 and ELEC 490

#### Electives

Electrical Engineering: Electives

#### Course Prerequisites

Normally, registration in a course offered by the ECE Department is allowed provided a mark of at least D- has been achieved in each of the prerequisites for the course. Students having one course prerequisite (numbered 200 or higher) with a mark of FR may still be able to register in a course offered by the Department provided their Engineering Cumulative GPA is at least 2.0 at the end of the previous session. Prerequisites are listed under the calendar description for each course.

#### Complementary Studies

ECEi students are required to take a total of five Complementary Studies courses over 2nd, 3rd and 4th year: two elective Complementary Studies courses from List A (Humanities and Social Sciences) and the required three List B/D courses COMM 301, COMM 302, and COMM 405.

### **Electrical Engineering, ECEi Stream, B.A.Sc. (Class of 2021)**

Elective courses in years three and four are to be chosen from Electives Lists A and B (shown under fourth year), and by consulting suggested Streams and prerequisite paths. Your complete degree program must:

- 1) Exceed the minimum Accreditation Units (AU) set by ECE in each CEAB category.
- 2) Have at least 5 courses from Electives List A.
- 3) Have at least 5 four-hundred level elective courses.
- 4) Counting required core courses, plus elective courses chosen for second, third and fourth years, result in a total of no fewer than 125.6 credits for those years (remaining AU balance is shown below after each year).

Available combinations of elective courses are subject to timetabling constraints.

### **Second Year CORE 2018-2019**

- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- COMM 201 Introduction to Business for Entrepreneurs F | 3
- ELEC 221 Electric Circuits F | 4.25
- ELEC 252 Electronics I W | 4.25
- ELEC 271 Digital Systems F | 4
- ELEC 273 NOT OFFERED 2019-2020 Numerical Methods and Optimization W | 3.5
- ELEC 274 Computer Architecture W | 4
- ELEC 278 Fundamentals of Information Structures F | 4
- ELEC 280 Fundamentals of Electromagnetics W | 3.75
- ELEC 299 Mechatronics Project W | K1.5
- MTHE 228 Complex Analysis W | 3.5
- MTHE 235 Differential Equations for Electrical and Computer Engineers F | 3.5
- Complementary Studies, List A F/W | 3

**Minimum Total Credits: 47**

**Remaining Credits Balance: 78.6**

### **Third Year CORE 2019-2020**

- COMM 301 Funding New Ventures F | 3
- ELEC 323 Continuous-Time Signals and Systems F | 3.75
- ELEC 324 Discrete-Time Signals and Systems W | 4
- ELEC 326 Probability and Random Processes F | 3.5
- ELEC 353 Electronics II F | 4.25
- ELEC 371 Microprocessor Interfacing and Embedded Systems F | 4

- ELEC 381 Applications of Electromagnetics F | 3.75
- COMM 302 Launching New Ventures W | 3
- ELEC 390 Principles of Design and Development W | K3.5 \*
- ENPH 336 Solid State Devices W | 3.25
- 2 Electives List A or B F/W | 6
- 1 of Complementary Studies List A F/W | 3

Minimum Total Credits: 43.75

Remaining Credits Balance: 34.85

\* with Departmental and instructor support, students may request to substitute APSC 381 and APSC 480 for ELEC 390 and ELEC 490

Fourth Year CORE 2020-2021

- ELEC 490 Electrical Engineering Project FW | K7
- COMM 405 New Business Development F | 3
- Electives F/W | 24.85

Minimum Total Credits: 34.85

Remaining Credits Balance: 0

\* with Departmental and instructor support, students may request to substitute APSC 381 and APSC 480 for ELEC 390 and ELEC 490

## Electives

Electrical Engineering: Electives

## Course Prerequisites

Normally, registration in a course offered by the ECE Department is allowed provided a mark of at least D- has been achieved in each of the prerequisites for the course. Students having one course prerequisite (numbered 200 or higher) with a mark of FR may still be able to register in a course offered by the Department provided their Engineering Cumulative GPA is at least 2.0 at the end of the previous session. Prerequisites are listed under the calendar description for each course.

## Complementary Studies

ECEi students are required to take a total of five Complementary Studies courses over 2nd, 3rd and 4th year: two elective Complementary Studies courses from List A (Humanities and Social Sciences) and the required three List B/D courses COMM 301, COMM 302, and COMM 405.

**Electrical Engineering, ECEi Stream, B.A.Sc. (Class of 2022)**

Elective courses in years three and four are to be chosen from Electives Lists A and B (shown under fourth year), and by consulting suggested Streams and prerequisite paths. Your complete degree program must:

- 1) Exceed the minimum Accreditation Units (AU) set by ECE in each CEAB category.
- 2) Have at least 5 courses from Electives List A.
- 3) Have at least 5 four-hundred level elective courses.
- 4) Counting required core courses, plus elective courses chosen for second, third and fourth years, result in a total of no fewer than 125.6 credits for those years (remaining AU balance is shown below after each year).

Available combinations of elective courses are subject to timetabling constraints.

## Second Year CORE 2019-2020

- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- COMM 201 Introduction to Business for Entrepreneurs F | 3
- ELEC 221 Electric Circuits F | 4.25
- ELEC 224 Continuous-Time Signals and Systems W | 3.75
- ELEC 252 Electronics I W | 4.25
- ELEC 271 Digital Systems F | 4
- ELEC 274 Computer Architecture W | 4
- ELEC 278 Fundamentals of Information Structures F | 4
- ELEC 280 Fundamentals of Electromagnetics W | 3.75
- ELEC 299 Mechatronics Project W | K1.5
- MTHE 228 Complex Analysis W | 3.5
- MTHE 235 Differential Equations for Electrical and Computer Engineers F | 3.5
- Complementary Studies, List A F/W | 3

Minimum Total Credits: 47.25

Remaining Credits Balance: 78.35

## Third Year CORE 2020-2021

- ELEC 324 Discrete-Time Signals and Systems W | 4
- COMM 301 Funding New Ventures F | 3
- ELEC 326 Probability and Random Processes F | 3.5
- ENPH 336 Solid State Devices W | 3.25
- 2 Electives List A or B F/W | 6
- Complementary Studies List A F/W | 3
- ELEC 353 Electronics II F | 4.25
- ELEC 371 Microprocessor Interfacing and Embedded Systems F | 4
- ELEC 372 NOT OFFERED 2019-2020 Numerical Methods and Optimization W | 3.5
- ELEC 381 Applications of Electromagnetics F | 3.75
- COMM 302 Launching New Ventures W | 3

- ELEC 324 Discrete-Time Signals and Systems F | 4
- ELEC 390 Principles of Design and Development W | K3.5 \*

Minimum Total Credits: 43.5

Remaining Credits Balance: 34.85

\* with Departmental and instructor support, students may request to substitute APSC 381 and APSC 480 for ELEC 390 and ELEC 490

Fourth Year CORE 2021-2022

- ELEC 490 Electrical Engineering Project FW | K7 \*
- COMM 405 New Business Development F| 3
- Electives F/W | 24.85

Minimum Total Credits: 34.85

Remaining Credits Balance: 0

\* with Departmental and instructor support, students may request to substitute APSC 381 and APSC 480 for ELEC 390 and ELEC 490

## Electives

Electrical Engineering: Electives

## Course Prerequisites

Normally, registration in a course offered by the Department is allowed provided a mark of at least D- has been achieved in each of the prerequisites for the course. Students having one course prerequisite (numbered 200 or higher) with a mark of FR may still be able to register in a course offered by the Department provided their Engineering Cumulative GPA is at least 2.0 at the end of the previous session. Prerequisites are listed under the calendar description for each course.

## Complementary Studies

ECEi students are required to take a total of five Complementary Studies courses over 2nd, 3rd and 4th year: two elective Complementary Studies courses from List A (Humanities and Social Sciences) and the required three List B/D courses COMM 301, COMM 302, and COMM 405.

## Electrical Engineering: Electives

### Electives List A

- ELEC 270 Discrete Mathematics with Computer Engineering Applications W | 3.5
- ELEC 279 Introduction to Object Oriented Programming W | 4
- ELEC 333 Electric Machines F | 4.5
- ELEC 344 Sensors and Actuators F | 3.75
- ELEC 373 Computer Networks W | 3.5
- ELEC 408 Biomedical Signal and Image Processing W | 3
- ELEC 409 NOT OFFERED 2019-2020 Bioinformatic Analytics W | 3
- ELEC 421 Digital Signal Processing: Filters and System Design F | 4
- ELEC 422 NOT OFFERED 2019-2020 Digital Signal Processing: Random Models and Applications F | 3
- ELEC 425 Machine Learning and Deep Learning F | 3.5
- ELEC 431 Power Electronics F | 3.25
- ELEC 433 Energy and Power Systems W | 3.5
- ELEC 436 NOT OFFERED 2019-2020 Electric Machines and Control W | 3
- ELEC 443 Linear Control Systems F | 4.25
- ELEC 444 NOT OFFERED 2019-2020 Modeling and Computer Control of Mechatronic Systems W | 3.25
  
- ELEC 448 Introduction to Robotics: Mechanics and Control W | 3.5  
OR
- MECH 456 NOT OFFERED 2019-2020 - Introduction to Robotics F | 3.5
  
- ELEC 451 Digital Integrated Circuit Engineering W | 3.25
- ELEC 454 Analog Electronics W | 3.25
- ELEC 457 NOT OFFERED 2019-2020 Integrated Circuits and System Applications F | 3.25
- ELEC 461 NOT OFFERED 2019-2020 Digital Communications F | 3.5
- ELEC 464 Wireless Communications F | 3
- ELEC 470 NOT OFFERED 2019-2020 Computer System Architecture W | 3.5
- ELEC 472 Artificial Intelligence and Interactive Systems W | 3.5
- ELEC 474 Machine Vision F | 3.5
- ELEC 483 NOT OFFERED 2019-2020 Microwave and RF Circuits and Systems W | 4.25
- ELEC 486 Fiber Optic Communications W | 3.75
- ELEC 497 Research Project FW/S | K3.5

## Electives List B

- CHEE 340 Biomedical Engineering W | 3.5
- ENPH 460 Laser Optics W | 3.5
- CMPE 3XX Any Third Year Computing Science Course | 3
- CMPE 4XX Any Fourth Year Computing Science Course | 3
- MTHE 337 Introduction to Operations Research Models W | 3
- MTHE 367 Engineering Data Analysis W | 3.5
- MTHE 430 Modern Control Theory F | 4
- MTHE 455 Stochastic Processes and Applications F | 3.5
- MTHE 472 Control of Stochastic Systems W | 3
- MTHE 474 Information Theory F | 3
- MTHE 477 Data Compression and Source Coding W | 3
- MTHE 478 NOT OFFERED 2019-2020 - Topics in Communication Theory F/W | 3
- MECH 228 Kinematics and Dynamics W | K3.5
- MECH 328 Dynamics and Vibration F | 3.5

- MECH 393 Biomechanical Product Development F | 3.5
- MECH 423 Introduction to Microsystems W | 3.5
- MECH 455 NOT OFFERED 2019-2020 - Computer Integrated Manufacturing F | 3.5
- MECH 465 Computer-Aided Design F | 3.5
- MECH 478 Biomaterials F | 3.5
- MECH 494 Kinematics of Human Motion F | 3.5
- MINE 472 Mining Systems, Automation, and Robotics O/L | K3.5
- APSC 400 Technology, Engineering & Management (TEAM) FW\* | 7 K7

## Engineering Chemistry

**Department Head** B. Amsden

**Chair of Undergraduate Studies** S. Parent

**Undergraduate Assistant** L.D. Joanne

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The Engineering Chemistry program is offered by the Department of Chemical Engineering with the close cooperation of the Department of Chemistry. The academic program is accredited by the Canadian Engineering Accreditation Board as an engineering discipline and the Canadian Society for Chemistry as a chemistry program. The curriculum integrates a core of chemistry with a body of engineering in a manner that allows chemical knowledge to be put into practice. Beginning with a concentration on basic engineering principles, science, and mathematics, students can gain specialization in areas such as process chemistry, materials science, biosciences and pharmaceuticals, through selection of electives and thesis project. They also work on group design projects throughout the design spine. In their fourth year students work on a year-long research thesis project, under the supervision of academic staff. All students have access to a computing facility, equipped with software programs and simulators.

## Ancillary Fees

Chemical Engineering and Engineering Chemistry students may be required to pay ancillary fees for course related learning materials, safety equipment and field trips.

## Engineering Chemistry, B.A.Sc. (Class of 2020)

### Second Year CORE 2017-2018

- CHEE 209 Analysis of Process Data F | 3.5
- CHEE 221 Chemical Processes and Systems F | 3.5
- ENCH 211 Main Group Chemistry F | 4.75
- ENCH 212 Principles of Chemical Reactivity F | 3.75
- ENCH 213 Introduction to Chemical Analysis F | 4.5
- MTHE 225 Ordinary Differential Equations F/W/S-OL | 3.5
- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- CHEE 210 Thermodynamics of Energy Conversion Systems W | 3.5
- CHEE 222 Process Dynamics and Numerical Methods W | 3.5
- CHEE 223 Fluid Mechanics W | 3.5

- ENCH 222 Methods of Structure Determination W | 3.75
- ENCH 245 Applied Organic Chemistry I W | 4.75

Minimum Total Credits: 47

### Third Year CORE 2018-2019

- CHEE 311 Fluid Phase and Reaction Equilibrium F | 3.5
- CHEE 321 Chemical Reaction Engineering F | 3.5
- CHEE 330 Heat and Mass Transfer F | 3.5
- CHEE 380 Biochemical Engineering F | 3.5
- ENCH 312 Transition Metal Chemistry F | 3.5
- CHEE 323 Industrial Catalysis w | 3.5
- CHEE 324 Organic Process Development W | 3.5
- CHEE 331 Design of Unit Operations w | K 4.5
- CHEE 361 Engineering Communications, Ethics & Professionalism W | K1
- ENCH 399 Experimental Chemistry II W | 3.5
- Electives (minimum 6 credits) F/W | 6

Plus One Of:

- APSC 221 Economics and Business Practices in Engineering F/W/S | 3<sup>1</sup>
- CHEE 310 Deleted-Engineering Innovation and Entrepreneurship F | 3.5<sup>1</sup>

Minimum Credits: 42.5

<sup>1</sup> ENCH students choose either APSC 221 or CHEE 310 (but not both). NOTE: This course will NOT be preloaded like CORE courses; students will need to register for their choice in SOLUS during registration.

### Fourth Year CORE 2019-2020

- CHEE 460 Applied Surface and Colloid Science F | 3.5
- ENCH 313 Quantum Mechanics F | 3.5
- CHEE 471 Chemical Process Design FW | K7
- ENCH 417 Research Project FW | 9
- CHEE 315 Laboratory Projects II F/W | 4
- CHEE 363 Electrochemical Engineering\* W | 3.5
- Electives (minimum 15 credits) F/W | 15

Minimum Total Credits: 45.5

Technical Electives:

Students in the ENCH program (Class of 2020 only) are required to take two (2) technical elective courses from the approved Group A list (any combination from Materials, Environment, Biosciences, and General lists), one (1)



technical elective course from the approved Group B list, and one (1) technical elective course from the approved Group A or Group B list.

NOTE: Some of these elective courses may not be available to students due to pre-requisite course requirements. The student is responsible for confirming that he/she has the necessary prerequisites or permission of the instructor.

NOTE: Course availability and the term in which a course is held can change from one academic year to the next. This can occur due to instructor availability or a change to departmental resources. Please refer to SOLUS to find out if the TECH course is offered for the upcoming year.

Engineering Chemistry: Technical Electives

### Complementary Studies:

Students choose 9 credits from the approved Lists A, B, C, or D of which 6 credits must be taken from List A.

Refer to the Complementary Studies section of this calendar for details regarding the requirements for all Engineering plans.

### Engineering Economics:

To meet the engineering economics requirement, students take either APSC 221 or CHEE 310 (this is a CORE course).

### Communications:

To meet the communications requirement, students take APSC 293 and CHEE 361 (these are CORE courses).

## **Engineering Chemistry, B.A.Sc. (Class of 2021)**

### Second Year CORE 2018-2019

- CHEE 209 Analysis of Process Data F | 3.5
- CHEE 221 Chemical Processes and Systems F | 3.5
- CHEE 270 ChemEtronics F | K3
- ENCH 211 Main Group Chemistry F | 4.75
- ENCH 212 Principles of Chemical Reactivity F | 3.75
- MTHE 225 Ordinary Differential Equations F/W/S-OL | 3.5
- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- CHEE 210 Thermodynamics of Energy Conversion Systems W | 3.5
- CHEE 222 Process Dynamics and Numerical Methods W | 3.5
- CHEE 223 Fluid Mechanics W | 3.5
- ENCH 222 Methods of Structure Determination W | 3.75
- ENCH 245 Applied Organic Chemistry I W | 4.75

Minimum Total Credits: 45.5

### Third Year CORE 2019-2020

- CHEE 311 Fluid Phase and Reaction Equilibrium F | 3.5
- CHEE 321 Chemical Reaction Engineering F | 3.5
- CHEE 330 Heat and Mass Transfer F | 3.5
- CHEE 380 Biochemical Engineering F | 3.5
- ENCH 213 Introduction to Chemical Analysis F | 4.75
- ENCH 312 Transition Metal Chemistry F | 3.5
- APSC 221 Economics and Business Practices in Engineering F/W/S | 3
- CHEE 324 Organic Process Development W | 3.5
- CHEE 331 Design of Unit Operations w | K 4.5
- CHEE 361 Engineering Communications, Ethics & Professionalism W | K1
- CHEE 363 Electrochemical Engineering\* W | 3.5
- ENCH 399 Experimental Chemistry II W | 3.5
- Electives (minimum 3 credits) F/W | 3

Minimum Credits: 44.38

#### Fourth Year CORE 2020-2021

- CHEE 460 Applied Surface and Colloid Science F | 3.5
- ENCH 313 Quantum Mechanics F | 3.5
- CHEE 471 Chemical Process Design FW | K7
- ENCH 417 Research Project FW | 9
- CHEE 315 Laboratory Projects II F/W | 4
- CHEE 463 NOT OFFERED 2019-2020 Electrochemical Energy Systems W | 3.5
- Electives (minimum 15 credits) F/W | 15

Minimum Total Credits: 45.5

#### Technical Electives:

Students in the ENCH program (Class of 2021) are required to take two (2) courses from the approved Group A list (any combination from Materials, Environment, Biosciences, and General lists), and one (1) course from the approved Group B list.

NOTE: Some of these elective courses may not be available to students due to pre-requisite course requirements. The student is responsible for confirming that he/she has the necessary prerequisites or permission of the instructor.

NOTE: Course availability and the term in which a course is held can change from one academic year to the next. This can occur due to instructor availability or a change to departmental resources. Please refer to SOLUS to find out if the TECH course is offered for the upcoming year.

Engineering Chemistry: Technical Electives

#### Complementary Studies:

Students choose 9 credits from the approved Lists A, B, C, or D of which 6 credits must be taken from List A.

Refer to the Complementary Studies section of this calendar for details regarding the requirements for all Engineering plans.

## Engineering Economics:

To meet the engineering economics requirement, students take APSC 221.

## Communications:

To meet the communications requirement, students take APSC 293 and CHEE 361 (these are CORE courses).

## Engineering Chemistry, B.A.Sc. (Class of 2022)

### Second Year CORE 2019-2020

- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- CHEE 209 Analysis of Process Data F | 3.5
- CHEE 210 Thermodynamics of Energy Conversion Systems W | 3.5
- CHEE 221 Chemical Processes and Systems F | 3.5
- CHEE 222 Process Dynamics and Numerical Methods W | 3.5
- CHEE 223 Fluid Mechanics W | 3.5
- CHEE 270 ChemEtronics F | K3
- ENCH 222 Methods of Structure Determination W | 3.75
- ENCH 211 Main Group Chemistry F | 4.75
- ENCH 245 Applied Organic Chemistry I W | 4.75
- ENCH 212 Principles of Chemical Reactivity F | 3.75
- MTHE 225 Ordinary Differential Equations F/W/S-OL | 3.5

Minimum Total Credits: 46.25

### Third Year CORE 2020-2021

- APSC 221 Economics and Business Practices in Engineering F/W/S | 3
- CHEE 311 Fluid Phase and Reaction Equilibrium F | 3.5
- CHEE 321 Chemical Reaction Engineering F | 3.5
- CHEE 324 Organic Process Development W | 3.5
- CHEE 330 Heat and Mass Transfer F | 3.5
- CHEE 331 Design of Unit Operations w | K 4.5
- CHEE 361 Engineering Communications, Ethics & Professionalism W | K1
- CHEE 363 Electrochemical Engineering\* W | 3.5
- CHEE 380 Biochemical Engineering F | 3.5
- ENCH 213 Introduction to Chemical Analysis F | 4.5
- ENCH 312 Transition Metal Chemistry F | 3.5
- ENCH 399 Experimental Chemistry II W | 3.5
- ELECTIVES (minimum 3 credits) F/W | 3

Minimum Total Credits: 44.25

## Fourth Year CORE 2021-2022

- CHEE 315 Laboratory Projects II F/W | 4
- CHEE 460 Applied Surface and Colloid Science F | 3.5
- CHEE 463 NOT OFFERED 2019-2020 Electrochemical Energy Systems W | 3.5
- CHEE 471 Chemical Process Design FW | K7
- ENCH 313 Quantum Mechanics F | 3.5
- ENCH 417 Research Project FW | 9
- Electives (minimum 15 credits) F/W | 15

Minimum Total Credits: 45.5

### Technical Electives:

Students in the ENCH program (Class of 2022) are required to take two (2) courses from the approved Group A list (any combination from Materials, Environment, Biosciences, and General lists), and one (1) course from the approved Group B list.

NOTE: Some of these elective courses may not be available to students due to pre-requisite course requirements. The student is responsible for confirming that he/she has the necessary prerequisites or permission of the instructor.

NOTE: Course availability and the term in which a course is held can change from one academic year to the next. This can occur due to instructor availability or a change to departmental resources. Please refer to SOLUS to find out if the TECH course is offered for the upcoming year.

Engineering Chemistry: Technical Electives

### Engineering Economics:

To meet the engineering economics requirement, students take APSC 221.

### Communications:

To meet the communications requirement, students take APSC 293 and CHEE 361 (these are CORE courses).

### Complementary Studies:

Students choose 9 credits from the approved Lists A, B, C, or D of which 6 credits must be taken from List A.

Refer to the Complementary Studies section of this calendar for details regarding the requirements for all Engineering plans.

### Engineering Chemistry: Technical Electives

#### Group A

#### Biotechnology

- CHEE 340 Biomedical Engineering W | 3.5
- CHEE 440 Pharmaceutical Technology W | 3.5
- MECH 478 Biomaterials F | 3.5
- MECH 492 Biological Fluid Dynamics F | 3.5

## Energy, Energy Resources, and Petroleum Engineering

- CHEE 414 Foundations of the Oil and Gas Industry w | 3.5
- MECH 435 Internal Combustion Engines W | 3.5
- MECH 437 Fuel Cell Technology F | 3.5
- MECH 439 Turbomachinery F | 3.5

## Environmental

- CHEE 342 Environmental Biotechnology F | 3.5
- CHEE 371 Mitigation of Industrial Pollution W | 3.5
- CHEE 484 NOT OFFERED 2019-2020 Bioremediation W | 3.5
- CIVL 371 Groundwater Engineering F | 3.75
- CIVL 372 Water and Wastewater Engineering W | 4
- CIVL 451 Lake, Reservoir and Coastal Engineering F | 3.75
- CIVL 471 Subsurface Contamination W | 4

## Materials

- CHEE 323 Industrial Catalysis w | 3.5
- CHEE 490 Polymer Formulations and Processing Technology W | 3.5
- MECH 393 Biomechanical Product Development F | 3.5

## Minerals Processing

- MINE 331 Methods of Mineral Separation F | 4.5
- MINE 335 Mineral Processing F | 3
- MINE 451 Chemical Extraction of Metals F | 3

## General

- APSC 381 Advanced Design and Skills for Innovation W | K3.5
- CHEE 319 Process Dynamics and Control W | 3.5
- CHEE 412 Transport Phenomena W | 3.5
- CHEE 418 Strategies for Process Investigations F | 3.5
- CHEE 434 Process Control II W | 3.5
- MECH 393 Biomechanical Product Development F | 3.5
- MECH 430 NOT OFFERED 2019-2020 Thermal Systems Design W | 4
- MECH 444 Computational Fluid Dynamics F | 3.5
- MECH 480 NOT OFFERED 2019-2020 - Airplane Aerodynamics and Performance W | 3.5

## Group B

All CHEM/ENCH courses numbered from 311 to 489, excluding those courses already required in the core of the program, can be considered as a Group B TECH course.

- ENCH 311 Mechanistic Organic Chemistry F | 3.5
- ENCH 321 Instrumental Chemical Analysis W | 3
- ENCH 322 The Chemical Bond: Computation and Spectroscopy W | 3.5
- ENCH 323 Biological Chemistry W | 3
- ENCH 326 Environmental and Green Chemistry W | 3
- ENCH 411 Advanced Analytical Chemistry F | 3
- ENCH 412 NOT OFFERED 2019-2020 - Statistical Mechanics W | 3
- ENCH 413 NOT OFFERED 2019-2020 Computational Chemistry W | 3
- ENCH 414 NOT OFFERED 2019-2020 - Catalysis F | 3
- ENCH 421 Advanced Methods in Physical Chemistry F | 3
- ENCH 422 Synthetic Organic Chemistry W | 3.5
- ENCH 423 Topics in Inorganic and Organometallic Chemistry W | 3
- ENCH 424 Polymer Chemistry W | 3
- ENCH 425 NOT OFFERED 2019-2020 Self-Assembly and Materials W | 3

## Engineering Physics

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**Chair of Undergraduate Studies** Jun Guo

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Core courses in the Engineering Physics plan provide the student with fundamental physical principles and theoretical tools for professional practice as well as a firm foundation in modern experimental techniques. To relate these abilities to the attitudes and knowledge of other engineering disciplines, the plan has four sub-plans: electrical, materials, mechanical, and computing. These sub-plans provide a sequence of courses in other engineering departments and thus provide career or graduate studies opportunities in both engineering and applied physics.

**NOTE: Students will not be registered in any core second year engineering physics courses until they have passed all the required first year mathematics and physics courses. It is strongly recommended that students have a grade of C- or better in the first year mathematics and physics courses.**

Fourth year elective courses must be chosen such that at the end of the academic plan each student meets or exceeds the Canadian Engineering Accreditation Board (CEAB) program requirements. A spreadsheet will be provided by the Undergraduate Chair to aid fourth year students with their course selection.

Options available:

- Electrical Option
- Materials Option
- Mechanical Option
- Computing Option

**Engineering Physics, B.A.Sc. (Class of 2020)**

## Second Year CORE - 2017-2018

- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- MTHE 227 Vector Analysis F | 3
- MTHE 237 Differential Equations for Engineering Science F | 3.25
- ENPH 242 Relativity and Quanta F | 3.5
- ELEC 221 Electric Circuits F | 4.25
- ENPH 211 Applied Physics W | 3.5
- ENPH 225 Mechanics W | 3.5
- ENPH 239 Electricity and Magnetism W | 3.5
- ENPH 252 Management of Experimental Data W | 1.25
- ENPH 253 Engineering Physics Laboratory W | K3.5
- ENPH 213 Computational Engineering Physics W | 4

### Electrical Sub-Plan (P1)

- ELEC 278 Fundamentals of Information Structures F | 4
- ELEC 252 Electronics I W | 4.25

Minimum Units: 46.5

### Materials Sub-Plan (P3)

- MECH 270 Materials Science and Engineering F | 3.5
- MECH 241 Fluid Mechanics I W/S-OL | 3.5

Minimum Units: 45.25

### Mechanical Sub-Plan (P4)

- MECH 230 Thermodynamics I F | 3.5
- MECH 241 Fluid Mechanics I W/S-OL | 3.5

Minimum Units: 45.25

### Computing Sub-Plan (P6)

- CMPE 212 Introduction to Computing Science II F/W | 4
- ELEC 278 Fundamentals of Information Structures F | 4

Minimum Units: 46.25

Notes:

\*\* Students are free to take Complementary Studies courses at any time in their program that suits their interests, workloads, and schedules. Read explanatory notes on Complementary Studies at the end of this section.

### Third Year CORE - 2018-2019

- MTHE 338 Fourier Methods for Boundary Value Problems F | 3.5 \*
- ENPH 344 Introduction to Quantum Mechanics F | 3.5
- ENPH 354 Engineering Physics Design Project W | 3.5
- APSC 221 Economics and Business Practices in Engineering F/W/S | 3
- Complementary Studies, List A F/W | 3 \*\*
- ENPH 345 Quantum Physics of Atoms, Nuclei and Particles W | 3.5
- ENPH 353 Engineering Physics Laboratory II F | 2.5

#### Notes:

\* MTHE 338 may be replaced by taking both ENPH 316 and ENPH 317. ENPH 317 can be taken in 3rd or 4th year and is a Physics List A elective.

\*\* Students are free to take Complementary Studies courses at any time in their program that suits their interests, workloads, and schedules. Read explanatory notes on Complementary Studies at the end of this section.

APSC 381 may be taken as a technical elective for students particularly interested in engineering design.

ENPH 491 and ENPH 495 are fourth year Physics List A electives offered every second year which students in their third year can consider taking.

Note: In February of Third Year students may apply for permission to take ENPH 456 and ENPH 457 as a combined alternate to (ENPH 455, a 4th year List "B" course, and the Engineering Elective), to facilitate an Accelerated Master's graduate degree ending 16 months after completion of the undergraduate Engineering Physics program. Details will be given in January of your 3rd year.

### Electrical Sub-Plan (P1)

- ELEC 323 Continuous-Time Signals and Systems F | 3.75
- ELEC 353 Electronics II F | 4.25
- ENPH 372 Thermodynamics W | 3.5
- ELEC 324 Discrete-Time Signals and Systems W | 4
- ENPH 336 Solid State Devices W | 3.25

Minimum Units: 41.25

### Materials Sub-Plan (P3)

- MECH 396 Mechanical and Materials Engineering Laboratory I F | K2
- MECH 370 Principles of Materials Processing F | 3.5
- ENPH 334 Electronics for Applied Scientists F | 5
- ENPH 372 Thermodynamics W | 3.5
- MECH 371 Fracture Mechanics and Dislocation Theory W | 3.5
- MECH 397 Mechanical and Materials Engineering Laboratory II W | K2



Minimum Units: 42

### Mechanical Sub-Plan (P4)

- ENPH 334 Electronics for Applied Scientists F | 5
- MECH 330 Applied Thermodynamics II F | 3.5
- MECH 341 Fluid Mechanics II W | 3.5
- MECH 346 Heat Transfer W | 3.5
- MECH 350 Automatic Control W | 3.5

Minimum Units: 41.5

### Computing Sub-Plan (P6)

- ELEC 271 Digital Systems F | 4
- ENPH 334 Electronics for Applied Scientists F | 5
- CMPE 320 Fundamentals of Software Development F | 4
- ELEC 274 Computer Architecture W | 4
- ENPH 372 Thermodynamics W | 3.5

Minimum Units: 43

### Fourth Year CORE - 2019-2020

- ENPH 431 Electromagnetic Theory F | 3.5
- ENPH 454 Advanced Engineering Physics Design Project F | 4.5 \*\*
- Complementary Studies, List A F/W | 3 \*\*
- Complementary Studies, List A, B, C or D F/W | 3 \*\*
- Engineering Elective (any 200-, 300-, or 400-level Engineering and Applied Science course) F/W | 3
- ENPH 455 Engineering Physics Thesis FW | 4 \*
- ENPH 453 Advanced Physics Laboratory W | 3.5

### Note:

\* Students may take (ENPH 456 and ENPH 457) as a combined alternate to ENPH 455, List "B" and Engineering Elective. See the description after 3rd year.

\*\* Students may instead take APSC 480, Multi-disciplinary Industry Engineering Design Project (9 credits FW) as a substitute for ENPH 454 and one list "B" course. Note that APSC 480 has a prerequisite of APSC 381 or permission of the instructor.

One from Physics List A:

### Physics List A:

- ENPH 317 Mathematical Methods in Physics II W | 3.5

- ENPH 321 Advanced Mechanics W | 3.5
- ENPH 414 Introduction to General Relativity F | 3
- ENPH 460 Laser Optics W | 3.5
- ENPH 472 Statistical Mechanics W | 3.5
- ENPH 479 High Performance Computing in Engineering Physics W |
- ENPH 480 Solid State Physics F | 3.5
- ENPH 483 NOT OFFERED 2019-2020 Nanoscience and Nanotechnology W | 3.5
- ENPH 490 Nuclear Physics F | 3.5
- ENPH 491 NOT OFFERED 2019-2020 Physics of Nuclear Reactors F | 3.5 <sup>1</sup>
- ENPH 495 Introduction to Medical Physics W | 3 <sup>2</sup>

Note:

<sup>1</sup> ENPH 491 will be offered in 2017/2018 and alternate years thereafter.

<sup>2</sup> ENPH 495 will be offered in 2018/2019 and alternate years thereafter.

## Electrical Sub-Plan (P1)

Two courses from Electrical List B, and one course from Electrical List B or Physics List A, at least one of which must be numbered above 400\*:

Electrical List B:

- ELEC 326 Probability and Random Processes F | 3.5
- ELEC 333 Electric Machines F | 4.5
- ELEC 344 Sensors and Actuators F | 3.75
- ELEC 373 Computer Networks W | 3.5
- ELEC 408 Biomedical Signal and Image Processing W | 3
- ELEC 409 NOT OFFERED 2019-2020 Bioinformatic Analytics W | 3
- ELEC 421 Digital Signal Processing: Filters and System Design F | 4
- ELEC 422 NOT OFFERED 2019-2020 Digital Signal Processing: Random Models and Applications F | 3
- ELEC 431 Power Electronics F | 3.25
- ELEC 443 Linear Control Systems F | 4.25
- ELEC 448 Introduction to Robotics: Mechanics and Control W | 3.5
- ELEC 451 Digital Integrated Circuit Engineering W | 3.25
- ELEC 454 Analog Electronics W | 3.25
- ELEC 457 NOT OFFERED 2019-2020 Integrated Circuits and System Applications F | 3.25
- ELEC 461 NOT OFFERED 2019-2020 Digital Communications F | 3.5
- ELEC 464 Wireless Communications F | 3
- ELEC 483 NOT OFFERED 2019-2020 Microwave and RF Circuits and Systems W | 4.25
- ELEC 486 Fiber Optic Communications W | 3.75
- CHEE 340 Biomedical Engineering W | 3.5

Note:

\* Students with the necessary prerequisites and/or permission of the instructor may replace a List B course above with a List B course from one of the other options within Engineering Physics.

Minimum Units: 36.5

### Materials Sub-Plan (P3)

- ENPH 480 Solid State Physics F | 3.5

Materials List B:

Two courses from Materials List B\*:

- MDEP 437 DELETED-Fuel Cell Technology F |
- MECH 423 Introduction to Microsystems W | 3.5
- MECH 470 Deformation Processing W | 3.5
- MECH 476 Engineering of Polymers and Composite Materials W | 3.5
- MECH 478 Biomaterials F | 3.5
- MECH 479 Nano-Structured Materials F | 3.5
- MECH 483 Nuclear Materials F | 3.5
- MECH 484 NOT OFFERED 2019-2020 - Introduction to Ceramics F | 3.5
- CHEE 340 Biomedical Engineering W | 3.5

Note:

\* Students with the necessary prerequisites and/or permission of the instructor may replace a list B course above with a list B course from one of the other options within Engineering Physics.

Minimum Units: 38

### Mechanical Sub-Plan (P4)

Three courses: two from Mechanical List B, and one from Physics List A or Mechanical List B\*:

Mechanical List B:

- CHEE 340 Biomedical Engineering W | 3.5
- MECH 420 Vibrations W | 3.5
- MECH 423 Introduction to Microsystems W | 3.5
- MECH 424 Sustainable Product Design F | 3.5
- MECH 430 NOT OFFERED 2019-2020 Thermal Systems Design W | 4
- MECH 435 Internal Combustion Engines W | 3.5
- MECH 437 Fuel Cell Technology F | 3.5
- MECH 439 Turbomachinery F | 3.5
- MECH 441 NOT OFFERED 2019/2020 - Fluid Mechanics III W | 3.5
- MECH 444 Computational Fluid Dynamics F | 3.5
- MECH 448 Compressible Fluid Flow F | 3.5
- MECH 452 Mechatronics Engineering F | 5
- MECH 456 NOT OFFERED 2019-2020 - Introduction to Robotics F | 3.5
- MECH 465 Computer-Aided Design F | 3.5
- MECH 480 NOT OFFERED 2019-2020 - Airplane Aerodynamics and Performance W | 3.5

- MECH 481 Wind Energy F | 3.5
- MECH 482 Noise Control W | 3.5
- MECH 492 Biological Fluid Dynamics F | 3.5
- MECH 495 Ergonomics and Design W | 3.5

Note:

\* Students with the necessary prerequisites and/or permission of the instructor may replace a List B course above with a List B course from one of the other options within Engineering Physics.

Minimum Units: 37.5

## Computing Sub-Plan (P6)

Three courses: two from Computing List B and one from Physics List A or Computing List B. At least one of the Computing List B courses must be numbered above 400\*:

Computing List B:

- CHEE 340 Biomedical Engineering W | 3.5
- CMPE 330 Computer-Integrated Surgery F | 3
- CMPE 365 Algorithms I F | 4
- CMPE 452 Neural Networks and Genetic Algorithms F | 3
- CMPE 454 Computer Graphics W | 3
- CMPE 457 Image Processing and Computer Vision F | 3
- CMPE 458 Programming Language Processors W | 4
- CMPE 472 Medical Informatics W | 3
- ELEC 371 Microprocessor Interfacing and Embedded Systems F | 4
- ELEC 374 Digital Systems Engineering W | 4.25 <sup>1</sup>
- ELEC 377 Operating Systems F | 4
- ELEC 408 Biomedical Signal and Image Processing W | 3
- ELEC 409 NOT OFFERED 2019-2020 Bioinformatic Analytics W | 3

Note:

<sup>1</sup>With permission of the instructor.

\* Students with the necessary prerequisites and/or permission of the instructor may replace a List B course above with a List B course from one of the other sub-plans within Engineering Physics.

Minimum Units: 36.5

## Complementary Studies:

Refer to the Complementary Studies section of this calendar for details regarding the requirements for all Engineering programs. For the Engineering Physics Plan, the Engineering Economics course is APSC 221, and the Communications requirements are met through courses in the core plan.

## **Engineering Physics, B.A.Sc. (Class of 2021)**

### **Second Year CORE 2018-2019**

- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- MTHE 227 Vector Analysis F | 3
- MTHE 237 Differential Equations for Engineering Science F | 3.25
- ENPH 242 Relativity and Quanta F | 3.5
- ELEC 221 Electric Circuits F | 4.25
- ENPH 211 Applied Physics W | 3.5
- ENPH 225 Mechanics W | 3.5
- ENPH 239 Electricity and Magnetism W | 3.5
- ENPH 252 Management of Experimental Data W | 1.25
- ENPH 253 Engineering Physics Laboratory W | K3.5
- ENPH 213 Computational Engineering Physics W | 4

### **Electrical Sub-Plan (P1)**

- ELEC 278 Fundamentals of Information Structures F | 4
- ELEC 252 Electronics I W | 4.25

Minimum Units: 46.5

### **Materials Sub-Plan (P3)**

- MECH 270 Materials Science and Engineering F | 3.5
- MECH 241 Fluid Mechanics I W/S-OL | 3.5

Minimum Units: 45.25

### **Mechanical Sub-Plan (P4)**

- MECH 230 Thermodynamics I F | 3.5
- MECH 241 Fluid Mechanics I W/S-OL | 3.5

Minimum Units: 45.25

### **Computing Sub-Plan (P6)**

- CMPE 212 Introduction to Computing Science II F/W | 4
- ELEC 278 Fundamentals of Information Structures F | 4

Minimum Units: 46.25

### **Third Year CORE 2019-2020**

- MTHE 338 Fourier Methods for Boundary Value Problems F | 3.5 \*
- ENPH 344 Introduction to Quantum Mechanics F | 3.5
- ENPH 354 Engineering Physics Design Project W | 3.5
- APSC 221 Economics and Business Practices in Engineering F/W/S | 3
- Complementary Studies, List A W | 3 \*\*
- ENPH 345 Quantum Physics of Atoms, Nuclei and Particles W | 3.5
- ENPH 353 Engineering Physics Laboratory II F | 2.5

#### Note:

\* MTHE 338 may be replaced by taking ENPH 316 and ENPH 317. ENPH 317 can be taken in 3rd or 4th year and is a Physics List A elective.

\*\* Students are free to take Complementary Studies courses at any time in their program that suits their interests, workloads, and schedules. Read explanatory notes on Complementary Studies at the end of this section.

APSC 381 may be taken as a technical elective for students particularly interested in engineering design.

ENPH 491 and ENPH 495 are fourth year Physics List A electives offered every second year which students in their third year can consider taking.

Note: In February of Third Year students may apply for permission to take ENPH 456 and ENPH 457 as a combined alternate to (ENPH 455, a 4th year List "B" course, and the Engineering Elective), to facilitate an **Accelerated Master's** graduate degree ending 16 months after completion of the undergraduate Engineering Physics program. Details will be given in January of your 3rd year.

#### Electrical Sub-Plan (P1)

- ELEC 323 Continuous-Time Signals and Systems F | 3.75
- ELEC 353 Electronics II F | 4.25
- ENPH 372 Thermodynamics W | 3.5
- ELEC 324 Discrete-Time Signals and Systems W | 4
- ENPH 336 Solid State Devices W | 3.25

Minimum Units: 41.25

#### Materials Sub-Plan (P3)

- MECH 396 Mechanical and Materials Engineering Laboratory I F | K2
- MECH 370 Principles of Materials Processing F | 3.5
- ENPH 334 Electronics for Applied Scientists F | 5
- ENPH 372 Thermodynamics W | 3.5
- MECH 371 Fracture Mechanics and Dislocation Theory W | 3.5
- MECH 397 Mechanical and Materials Engineering Laboratory II W | K2

Minimum Units: 42

#### Mechanical Sub-Plan (P4)

- ENPH 334 Electronics for Applied Scientists F | 5
- MECH 330 Applied Thermodynamics II F | 3.5
- MECH 341 Fluid Mechanics II W | 3.5
- MECH 346 Heat Transfer W | 3.5
- MECH 350 Automatic Control W | 3.5

Minimum Units: 41.5

### Computing Sub-Plan (P6)

- ELEC 271 Digital Systems F | 4
- ENPH 334 Electronics for Applied Scientists F | 5
- CMPE 320 Fundamentals of Software Development F | 4
- ELEC 274 Computer Architecture W | 4
- ENPH 372 Thermodynamics W | 3.5

Minimum Units: 43

### Fourth Year CORE 2020-2021

- ENPH 431 Electromagnetic Theory F | 3.5
- ENPH 454 Advanced Engineering Physics Design Project F | 4.5 \*\*
- Complementary Studies, List A F/W | 3 \*\*
- Complementary Studies, List A, B, C or D F/W | 3 \*\*
- Engineering Elective (any 200- 300- or 400-level Engineering and Applied Science course) F/W | 3
- ENPH 455 Engineering Physics Thesis FW | 4 \*
- ENPH 453 Advanced Physics Laboratory W | 3.5

### Note:

\* Students may take (ENPH 456 and ENPH 457) as a combined alternate to ENPH 455, List "B" and Engineering Elective. See the description after 3rd year.

\*\* Students may instead take APSC 480, Multi-disciplinary Industry Engineering Design Project (9 credits FW) as a substitute for ENPH 454 and one list "B" course. Note that APSC 480 has a prerequisite of APSC 381 or permission of the instructor.

### Physics List A:

One from Physics List A:

- ENPH 317 Mathematical Methods in Physics II W | 3.5
- ENPH 321 Advanced Mechanics W | 3.5
- ENPH 414 Introduction to General Relativity F | 3
- ENPH 460 Laser Optics W | 3.5
- ENPH 472 Statistical Mechanics W | 3.5
- ENPH 479 High Performance Computing in Engineering Physics W |
- ENPH 480 Solid State Physics F | 3.5

- ENPH 483 NOT OFFERED 2019-2020 Nanoscience and Nanotechnology W | 3.5
- ENPH 490 Nuclear Physics F | 3.5
- ENPH 491 NOT OFFERED 2019-2020 Physics of Nuclear Reactors F | 3.5 <sup>1</sup>
- ENPH 495 Introduction to Medical Physics W | 3 <sup>2</sup>

Note:

<sup>1</sup> ENPH 491 will be offered in 2017/2018 and alternate years thereafter.

<sup>2</sup> ENPH 495 will be offered in 2018/2019 and alternate years thereafter.

### Electrical Sub-Plan (P1)

Two courses from Electrical List B, and one course from Electrical List B or Physics List A, at least one of which must be numbered above 400\*:

Electrical List B:

- ELEC 326 Probability and Random Processes F | 3.5
- ELEC 333 Electric Machines F | 4.5
- ELEC 344 Sensors and Actuators F | 3.75
- ELEC 373 Computer Networks W | 3.5
- ELEC 408 Biomedical Signal and Image Processing W | 3
- ELEC 409 NOT OFFERED 2019-2020 Bioinformatic Analytics W | 3
- ELEC 421 Digital Signal Processing: Filters and System Design F | 4
- ELEC 422 NOT OFFERED 2019-2020 Digital Signal Processing: Random Models and Applications F | 3
- ELEC 431 Power Electronics F | 3.25
- ELEC 443 Linear Control Systems F | 4.25
- ELEC 448 Introduction to Robotics: Mechanics and Control W | 3.5
- ELEC 451 Digital Integrated Circuit Engineering W | 3.25
- ELEC 454 Analog Electronics W | 3.25
- ELEC 457 NOT OFFERED 2019-2020 Integrated Circuits and System Applications F | 3.25
- ELEC 461 NOT OFFERED 2019-2020 Digital Communications F | 3.5
- ELEC 464 Wireless Communications F | 3
- ELEC 483 NOT OFFERED 2019-2020 Microwave and RF Circuits and Systems W | 4.25
- ELEC 486 Fiber Optic Communications W | 3.75
- CHEE 340 Biomedical Engineering W | 3.5

Note:

\* Students with the necessary prerequisites and/or permission of the instructor may replace a List B course above with a List B course from one of the other options within Engineering Physics.

Minimum Units: 36.5

### Materials Sub-Plan (P3)

- ENPH 480 Solid State Physics F | 3.5



## Materials List B:

Two courses from Materials List B\*:

- MDEP 437 DELETED-Fuel Cell Technology F |
- MECH 423 Introduction to Microsystems W | 3.5
- MECH 470 Deformation Processing W | 3.5
- MECH 476 Engineering of Polymers and Composite Materials W | 3.5
- MECH 478 Biomaterials F | 3.5
- MECH 479 Nano-Structured Materials F | 3.5
- MECH 483 Nuclear Materials F | 3.5
- MECH 484 NOT OFFERED 2019-2020 - Introduction to Ceramics F | 3.5
- CHEE 340 Biomedical Engineering W | 3.5

Note:

\* Students with the necessary prerequisites and/or permission of the instructor may replace a list B course above with a list B course from one of the other options within Engineering Physics.

Minimum Units: 38

## Mechanical Sub-Plan (P4)

Three courses: two from Mechanical List B, and one from Physics List A or Mechanical List B\*:

### Mechanical List B:

Three courses: two from Mechanical List B, and one from Physics List A or Mechanical List B\*:

- CHEE 340 Biomedical Engineering W | 3.5
- MECH 420 Vibrations W | 3.5
- MECH 423 Introduction to Microsystems W | 3.5
- MECH 424 Sustainable Product Design F | 3.5
- MECH 430 NOT OFFERED 2019-2020 Thermal Systems Design W | 4
- MECH 435 Internal Combustion Engines W | 3.5
- MECH 437 Fuel Cell Technology F | 3.5
- MECH 439 Turbomachinery F | 3.5
- MECH 441 NOT OFFERED 2019/2020 - Fluid Mechanics III W | 3.5
- MECH 444 Computational Fluid Dynamics F | 3.5
- MECH 448 Compressible Fluid Flow F | 3.5
- MECH 452 Mechatronics Engineering F | 5
- MECH 456 NOT OFFERED 2019-2020 - Introduction to Robotics F | 3.5
- MECH 465 Computer-Aided Design F | 3.5
- MECH 480 NOT OFFERED 2019-2020 - Airplane Aerodynamics and Performance W | 3.5
- MECH 481 Wind Energy F | 3.5
- MECH 482 Noise Control W | 3.5
- MECH 492 Biological Fluid Dynamics F | 3.5
- MECH 495 Ergonomics and Design W | 3.5

Note:

\* Students with the necessary prerequisites and/or permission of the instructor may replace a List B course above with a List B course from one of the other options within Engineering Physics.

Minimum Units: 37.5

### Computing Sub-Plan (P6)

Three courses: two from Computing List B and one from Physics List A or Computing List B. At least one of the Computing List B courses must be numbered above 400\*:

Computing List B:

- CHEE 340 Biomedical Engineering W | 3.5
- CMPE 330 Computer-Integrated Surgery F | 3
- CMPE 365 Algorithms I F | 4
- CMPE 452 Neural Networks and Genetic Algorithms F | 3
- CMPE 454 Computer Graphics W | 3
- CMPE 457 Image Processing and Computer Vision F | 3
- CMPE 458 Programming Language Processors W | 4
- CMPE 472 Medical Informatics W | 3
- ELEC 371 Microprocessor Interfacing and Embedded Systems F | 4
- ELEC 374 Digital Systems Engineering W | 4.25 <sup>1</sup>
- ELEC 377 Operating Systems F | 4
- ELEC 408 Biomedical Signal and Image Processing W | 3
- ELEC 409 NOT OFFERED 2019-2020 Bioinformatic Analytics W | 3

Note:

<sup>1</sup>With permission of the instructor.

\* Students with the necessary prerequisites and/or permission of the instructor may replace a List B course above with a List B course from one of the other sub-plans within Engineering Physics.

Minimum Units: 36.5

### Complementary Studies:

Refer to the Complementary Studies section of this calendar for details regarding the requirements for all Engineering programs. For the Engineering Physics Plan, the Engineering Economics course is APSC 221, and the Communications requirements are met through courses in the core plan.

### Engineering Physics, B.A.Sc. (Class of 2022)

#### Second Year CORE 2019-2020

- APSC 200 Engineering Design and Practice II F/W | K4

- APSC 293 Engineering Communications I F/W | K1
- ELEC 221 Electric Circuits F | 4.25
- ENPH 211 Applied Physics W | 3.5
- ENPH 213 Computational Engineering Physics W | 4
- ENPH 225 Mechanics W | 3.5
- ENPH 239 Electricity and Magnetism W | 3.5
- ENPH 242 Relativity and Quanta F | 3.5
- ENPH 252 Management of Experimental Data W | 1.25
- ENPH 253 Engineering Physics Laboratory W | K3.5
- MTHE 227 Vector Analysis F | 3
- MTHE 237 Differential Equations for Engineering Science F | 3.25

### Electrical Sub-Plan (P1)

- ELEC 252 Electronics I W | 4.25
- ELEC 278 Fundamentals of Information Structures F | 4

Minimum Units: 46.5

### Materials Sub-Plan (P3)

- MECH 241 Fluid Mechanics I W/S-OL | 3.5
- MECH 270 Materials Science and Engineering F | 3.5

Minimum Units: 45.25

### Mechanical Sub-Plan (P4)

- MECH 230 Thermodynamics I F | 3.5
- MECH 241 Fluid Mechanics I W/S-OL | 3.5

Minimum Units: 45.25

### Computing Sub-Plan (P6)

- CMPE 212 Introduction to Computing Science II F/W | 4
- ELEC 278 Fundamentals of Information Structures F | 4

Minimum Units: 46.25

### Third Year CORE 2020-2021

- APSC 221 Economics and Business Practices in Engineering F/W/S | 3
- ENPH 344 Introduction to Quantum Mechanics F | 3.5
- ENPH 345 Quantum Physics of Atoms, Nuclei and Particles W | 3.5
- ENPH 353 Engineering Physics Laboratory II F | 2.5

- ENPH 354 Engineering Physics Design Project W | 3.5
- MTHE 338 Fourier Methods for Boundary Value Problems F | 3.5 \*
- Complementary Studies, List A W | 3 \*\*

## Notes:

\* MTHE 338 may be replaced by taking ENPH 316 and ENPH 317 . ENPH 317 can be taken in 3rd or 4th year and is a Physics List A elective.

\*\* Students are free to take Complementary Studies courses at any time in their program that suits their interests, workloads, and schedules. Read explanatory notes on Complementary Studies at the end of this section.

APSC 381 may be taken as a technical elective for students particularly interested in engineering design.

ENPH 491 and ENPH 495 are fourth year Physics List A electives offered every second year which students in their third year can consider taking.

Note: In February of Third Year students may apply for permission to take ENPH 456 and ENPH 457 as a combined alternate to (ENPH 455 , a 4th year List "B" course, and the Engineering Elective), to facilitate an **Accelerated Master's** graduate degree ending 16 months after completion of the undergraduate Engineering Physics program. Details will be given in January of your 3rd year.

## Electrical Sub-Plan (P1)

- ELEC 323 Continuous-Time Signals and Systems F | 3.75
- ELEC 324 Discrete-Time Signals and Systems W | 4
- ELEC 353 Electronics II F | 4.25
- ENPH 336 Solid State Devices W | 3.25
- ENPH 372 Thermodynamics W | 3.5

Minimum Units: 41.25

## Materials Sub-Plan (P3)

- ENPH 334 Electronics for Applied Scientists F | 5
- ENPH 372 Thermodynamics W | 3.5
- MECH 370 Principles of Materials Processing F | 3.5
- MECH 371 Fracture Mechanics and Dislocation Theory W | 3.5
- MECH 396 Mechanical and Materials Engineering Laboratory I F | K2
- MECH 397 Mechanical and Materials Engineering Laboratory II W | K2

Minimum Units: 42

## Mechanical Sub-Plan (P4)

- ENPH 334 Electronics for Applied Scientists F | 5
- MECH 330 Applied Thermodynamics II F | 3.5
- MECH 341 Fluid Mechanics II W | 3.5
- MECH 346 Heat Transfer W | 3.5

- MECH 350 Automatic Control W | 3.5

Minimum Units: 41.5

### Computing Sub-Plan (P6)

- CMPE 320 Fundamentals of Software Development F | 4
- ELEC 271 Digital Systems F | 4
- ELEC 274 Computer Architecture W | 4
- ENPH 334 Electronics for Applied Scientists F | 5
- ENPH 372 Thermodynamics W | 3.5

Minimum Units: 43

### Fourth Year CORE 2021-2022

- ENPH 431 Electromagnetic Theory F | 3.5
- ENPH 453 Advanced Physics Laboratory W | 3.5
- ENPH 454 Advanced Engineering Physics Design Project F | 4.5 \*\*
- ENPH 455 Engineering Physics Thesis FW | 4 \*
- Complementary Studies, List A F/W | 3
- Complementary Studies, List A, B, C or D F/W | 3
- Engineering Elective (any 200-, 300- or 400-level Engineering and Applied Science course) F/W | 3

### Notes:

\* Students may take (ENPH 456 and ENPH 457) as a combined alternate to ENPH 455, List "B" and Engineering Elective. See the description after 3rd year.

\*\* Students may instead take APSC 480 Multi-disciplinary Industry Engineering Design Project (9 credits FW) as a substitute for ENPH 454 and one list "B" course. Note that APSC 480 has a prerequisite of APSC 381 or permission of the instructor.

One from Physics List A:

### Physics List A:

- ENPH 317 Mathematical Methods in Physics II W | 3.5
- ENPH 321 Advanced Mechanics W | 3.5
- ENPH 414 Introduction to General Relativity F | 3
- ENPH 460 Laser Optics W | 3.5
- ENPH 472 Statistical Mechanics W | 3.5
- ENPH 479 High Performance Computing in Engineering Physics W |
- ENPH 480 Solid State Physics F | 3.5
- ENPH 483 NOT OFFERED 2019-2020 Nanoscience and Nanotechnology W | 3.5
- ENPH 490 Nuclear Physics F | 3.5

- ENPH 491 NOT OFFERED 2019-2020 Physics of Nuclear Reactors F | 3.5 <sup>1</sup>
- ENPH 495 Introduction to Medical Physics W | 3 <sup>2</sup>

Note:

<sup>1</sup> ENPH 491 will be offered in 2017/2018 and alternate years thereafter.

<sup>2</sup> ENPH 495 will be offered in 2018/2019 and alternate years thereafter.

## Electrical Sub-Plan (P1)

Two courses from Electrical List B, and one course from Electrical List B or Physics List A, at least one of which must be numbered above 400\*:

Electrical List B:

- ELEC 326 Probability and Random Processes F | 3.5
- ELEC 333 Electric Machines F | 4.5
- ELEC 344 Sensors and Actuators F | 3.75
- ELEC 373 Computer Networks W | 3.5
- ELEC 408 Biomedical Signal and Image Processing W | 3
- ELEC 409 NOT OFFERED 2019-2020 Bioinformatic Analytics W | 3
- ELEC 421 Digital Signal Processing: Filters and System Design F | 4
- ELEC 422 NOT OFFERED 2019-2020 Digital Signal Processing: Random Models and Applications F | 3
- ELEC 431 Power Electronics F | 3.25
- ELEC 443 Linear Control Systems F | 4.25
- ELEC 448 Introduction to Robotics: Mechanics and Control W | 3.5
- ELEC 451 Digital Integrated Circuit Engineering W | 3.25
- ELEC 454 Analog Electronics W | 3.25
- ELEC 457 NOT OFFERED 2019-2020 Integrated Circuits and System Applications F | 3.25
- ELEC 461 NOT OFFERED 2019-2020 Digital Communications F | 3.5
- ELEC 464 Wireless Communications F | 3
- ELEC 483 NOT OFFERED 2019-2020 Microwave and RF Circuits and Systems W | 4.25
- ELEC 486 Fiber Optic Communications W | 3.75
- CHEE 340 Biomedical Engineering W | 3.5

Note:

\* Students with the necessary prerequisites and/or permission of the instructor may replace a List B course above with a List B course from one of the other options within Engineering Physics.

Minimum Units: 36.5

## Materials Sub-Plan (P3)

- ENPH 480 Solid State Physics F | 3.5

Materials List B:

Two courses from Materials List B\*:

- MDEP 437 DELETED-Fuel Cell Technology F |
- MECH 423 Introduction to Microsystems W | 3.5
- MECH 470 Deformation Processing W | 3.5
- MECH 476 Engineering of Polymers and Composite Materials W | 3.5
- MECH 478 Biomaterials F | 3.5
- MECH 479 Nano-Structured Materials F | 3.5
- MECH 483 Nuclear Materials F | 3.5
- MECH 484 NOT OFFERED 2019-2020 - Introduction to Ceramics F | 3.5
- CHEE 340 Biomedical Engineering W | 3.5

Note:

\* Students with the necessary prerequisites and/or permission of the instructor may replace a list B course above with a list B course from one of the other options within Engineering Physics.

Minimum Units: 38

### Mechanical Sub-Plan (P4)

Three courses: two from Mechanical List B, and one from Physics List A or Mechanical List B\*:

Mechanical List B:

- CHEE 340 Biomedical Engineering W | 3.5
- MECH 420 Vibrations W | 3.5
- MECH 423 Introduction to Microsystems W | 3.5
- MECH 424 Sustainable Product Design F | 3.5
- MECH 430 NOT OFFERED 2019-2020 Thermal Systems Design W | 4
- MECH 435 Internal Combustion Engines W | 3.5
- MECH 437 Fuel Cell Technology F | 3.5
- MECH 439 Turbomachinery F | 3.5
- MECH 441 NOT OFFERED 2019/2020 - Fluid Mechanics III W | 3.5
- MECH 444 Computational Fluid Dynamics F | 3.5
- MECH 448 Compressible Fluid Flow F | 3.5
- MECH 452 Mechatronics Engineering F | 5
- MECH 456 NOT OFFERED 2019-2020 - Introduction to Robotics F | 3.5
- MECH 465 Computer-Aided Design F | 3.5
- MECH 480 NOT OFFERED 2019-2020 - Airplane Aerodynamics and Performance W | 3.5
- MECH 481 Wind Energy F | 3.5
- MECH 482 Noise Control W | 3.5
- MECH 492 Biological Fluid Dynamics F | 3.5
- MECH 495 Ergonomics and Design W | 3.5

Note:

\* Students with the necessary prerequisites and/or permission of the instructor may replace a List B course above with a List B course from one of the other options within Engineering Physics.

Minimum Units: 37.5

## Computing Sub-Plan (P6)

Three courses: two from Computing List B and one from Physics List A or Computing List B. At least one of the Computing List B courses must be numbered above 400\*:

### Computing List B:

- CHEE 340 Biomedical Engineering W | 3.5
- CMPE 330 Computer-Integrated Surgery F | 3
- CMPE 365 Algorithms I F | 4
- CMPE 452 Neural Networks and Genetic Algorithms F | 3
- CMPE 454 Computer Graphics W | 3
- CMPE 457 Image Processing and Computer Vision F | 3
- CMPE 458 Programming Language Processors W | 4
- CMPE 472 Medical Informatics W | 3
- ELEC 371 Microprocessor Interfacing and Embedded Systems F | 4
- ELEC 374 Digital Systems Engineering W | 4.25 <sup>1</sup>
- ELEC 377 Operating Systems F | 4
- ELEC 408 Biomedical Signal and Image Processing W | 3
- ELEC 409 NOT OFFERED 2019-2020 Bioinformatic Analytics W | 3

Note:

<sup>1</sup>With permission of the instructor.

\* Students with the necessary prerequisites and/or permission of the instructor may replace a List B course above with a List B course from one of the other sub-plans within Engineering Physics.

Minimum Units: 36.5

## Complementary Studies:

Refer to the Complementary Studies section of this calendar for details regarding the requirements for all Engineering programs. For the Engineering Physics Plan, the Engineering Economics course is APSC 221 , and the Communications requirements are met through courses in the core plan.

## First Year, Engineering and Applied Science

### First Year Studies, B.A.Sc.

The first year of study in Engineering and Applied Science is based on a common curriculum and serves as an introduction to all of the academic plans offered by the Faculty. The choice of academic plan the student intends to follow in the second and subsequent years is made in February in the Winter Term of the first year.



## Electrical and Computer Engineering Innovation (ECEi) Stream

This program is intended for students with an interest in innovation and entrepreneurship who want to enter electrical or computer engineering in first year. The ECEi focuses on developing entrepreneurial skills alongside the technical and professional elements that are the hallmark of Queen's Engineering.

In the first year of the program students will take broad fundamental courses in math, science, and professional skills supplemented by an entrepreneurial design project specifically designed with for ECEi students. At the end of first year students choose between electrical or computer engineering, and develop strong technical fundamentals and skills necessary for innovation including economics and business practices, design and creativity, and teamwork.

Details about these streams are listed in the calendar at:

[https://calendar.engineering.queensu.ca/preview\\_program.php?catoid=8&poid=499&returnto=213](https://calendar.engineering.queensu.ca/preview_program.php?catoid=8&poid=499&returnto=213)

### First Year Curriculum

- APSC 100 Engineering Practice I FW | K9
- APSC 199 English Proficiency for Engineers FW, S | K0.2
  
- APSC 111 Physics I F | 3.3
- APSC 131 Chemistry and Materials F | 3.3
- APSC 143 Introduction to Computer Programming for Engineers F | 3.3
- APSC 151 Earth Systems Engineering F | 3.3
- APSC 171 Calculus I F | 3.3
  
- APSC 112 Physics II W | 3.3
- APSC 114 Electricity and Magnetism W | 3.3
- APSC 132 Chemistry and its Applications W | 3.3
- APSC 162 Engineering Graphics W | 2.5
- APSC 172 Calculus II W | 3.3
- APSC 174 Introduction to Linear Algebra W | 3.3
- APSC 182 Applied Engineering Mechanics W, F | 1.7

Minimum Total Credits: 43.1

### First Year Advice and Counseling

First Year students looking for academic advice and counseling are encouraged to contact the Program Associate, Student Services, Faculty of Engineering and Applied Science by phone at 533-2055 or by email at [engineering.first.year@queensu.ca](mailto:engineering.first.year@queensu.ca).

### The Douglas Help Desk

A gift from Dr. James Douglas (Queen's BA, 1858) in 1910 made possible the establishment of a program by which First Year students are tutored by students selected from senior years. Details are available in the Faculty Office, and on the web at <http://engineering.queensu.ca/Current-Students/First-Year-Studies/DouglasTutorials.html>

### The Engineering Society (EngSoc) Engvents

**The EngSoc Engvents** The Engvents Committee's mandate is to connect engineering students of all years and disciplines through team based competitions and social events hosted throughout the year. Past events have included paintballing, dodgeball tournaments, bowling nights, amazing race style scavenger hunts, and even a Boat Cruise on Lake Ontario! So come on out, connect with fellow engineers, and have a great time with Engvents! If you have any questions or would like to get involved with Engvents, contact [engvents@engsoc.queensu.ca](mailto:engvents@engsoc.queensu.ca).

## The Engineering Society (EngSoc) 'EngLinks' Tutoring System

For help using the EngSoc 'EngLinks' Tutoring System, see <http://englinks.ca/>

## The Extended Program

The Extended Program provides an opportunity for First Year students who experience difficulties with the introductory courses APSC 111, APSC 131, and/or APSC 171 in the fall semester to retake these courses in the winter semester. Registration in the Extended Program takes place in early January. The courses normally completed in December are reviewed, and final examinations are rewritten in February during Reading Week. Instruction in the second term courses in APSC 112, APSC 132, APSC 172 and APSC 174 begins after Reading Week, is suspended when regular Winter term lectures end, and resumes after the normal examination period. These second term courses are completed in June. There is a special fee for each course in the Spring term (see the Section on Fees) \*

## Orientation Nights

In late January and early February each department holds an Orientation Night for first year students to introduce them to the department and to its academic plan(s). Students are encouraged to attend as many of these evening seminars as possible to help them make their plan choice. Help in reaching a decision regarding future studies can also be obtained in private discussions with upper year students, instructors, and the Program Associate, Student Services in the Faculty Office. Help is available on web pages maintained the departments in the Faculty (see <http://engineering.queensu.ca/Current-Students/First-Year-Studies/DisciplineOrientationSchedule.html>).

## Choice of Program: Preregistration

First year students preregister in February to indicate the academic plan in which they intend to register in the academic year. A student will be admitted to the plan of their choice, provided the first year requirements have been met. Having preregistered in one plan, it may be possible to apply to transfer to another at a later date. However, such a change must be approved, in advance, by the department offering the academic plan in which the student wishes to register.

## Admission to a Second Year Program

The rules governing the admission to the second year are given in the Faculty Regulations Section: in particular, Regulations 2f, 2g, and 10. Briefly, if a student has passed all of the courses in the First Year plan with marks of 1.6 ECGPA or better, admission to the second year will be unconditional. Otherwise, there may be constraints. Advice should be sought from the Faculty Office, or from the Chair of Undergraduate Studies in the program of choice.

## Geological Engineering

**Department Head** Dr. V.H. Remenda, PEng.

**Chair of Undergraduate Studies** Dr. M. Diederichs, PEng, FEIC

**Undergraduate Faculty Advisor** Dr. G. Fotopoulos, PEng,

**Undergraduate Assistant** L. Zarichny

**Office** Miller Hall, Bruce Wing

**Telephone** (613) 533-2597

**E-mail** zarichny@queensu.ca

**Departmental Web Site** <http://www.queensu.ca/geol/> (also [www.geol.ca](http://www.geol.ca))

Geological Engineering is a broad and creative field of engineering which combines practical application of geological principles, concepts and techniques with engineering investigation, analysis and design, providing reliable and sustainable engineered solutions to human needs.

Geological Engineering at Queen's University prepares students for the creative problem solving, analysis, interpretation and decision making necessary to tackle engineering challenges related to:

- Design and application of advanced surface and subsurface investigation, field and lab data interpretation, advanced analysis and geological modelling in aid of engineering design;
- Environmental engineering including subsurface water resource exploration and protection, ground contaminant remediation, sustainable mine/urban/industrial waste management/engineering;
- Geotechnical engineering and construction on, with or through earth materials (rock and soil) including tunnels, caverns, mines, transportation infrastructure, foundations, dams, waste storage;
- Geo-hazard assessment and risk mitigation including landslides, subsidence, earthquakes and floods;
- Mineral and energy resource exploration, evaluation, development and sustainable management, including environmental protection and remediation before, during and after geo-resource extraction;
- Applied Geophysics (eg. Seismics, electro-magnetics, gravity, laser, radar, etc) for remote probing (from the ground or from space) and visualization of the subsurface environment to facilitate geotechnical, geo-hazard, geo-environmental or geo-resource engineering.

The academic plan provides an enhanced understanding of the geological model associated with a particular challenge from the list above allowing in-depth assessment and understanding of the engineering properties of earth materials, including natural variability within and between different environments, sensitivity of these materials to genesis and tectonic history, the changes to earth materials with time within an engineering context, and the impacts on the reliability and sustainability of design solutions.

The Geological Engineering plan offers a common second year curriculum, to provide students with a foundation in geological sciences, math and physics in addition to broad introductory exposure to a variety of geo-engineering problems and design approaches. The extensive and well-rounded core program offered in third and fourth year is augmented by a number of technical elective choices. This allows each student to gain in-depth specialization by taking several courses in an area of interest, geotechnical engineering, geo-environmental engineering, including mineral and energy exploration, or geophysics. Alternatively, a student can choose to build a breadth of knowledge across the discipline of Geological Engineering.

### **Geological Engineering Curriculum**

It is recommended that students consult the academic advisor at least once in each year of their plan, to ensure that they are taking the required number of Technical Electives and Complementary Studies courses to fulfill the academic plan requirements as well as those of the Canadian Engineering Accreditation Board. Students need to plan ahead to ensure that they take courses in the appropriate years along with the necessary prerequisites.

Revisions to the Geological Engineering plan are ongoing. There are separate sections for the Classes of 2017, 2018, and 2019. Please refer to the appropriate calendar for your year of graduation.

The Technical Elective (TE) List is given at the end of this section. Complementary Studies (CE) are discussed at the end of each year calendar entry. For the classes of 2018 and 2019, students may take elective courses (4 TE and 3 CE) in any of the elective slots available in the 3rd and 4th years of the plan. For the class of 2017, a total of 5 TE and 3 CE are required.

### **Field Work**

Field work is an essential part of Geological Engineering training, both to gain field skills and to understand the sources and nature of the data to be used for analysis and design. Field trips and field projects are offered in each year of study because the Department wishes to provide the best experience-based education possible. Employers and alumni from the Department are universally enthusiastic about the value of this component of the Geological Engineering plan. In accordance with University policies, students will receive specialized instruction in field safety.

A field skills course, with trips around the Kingston area, is undertaken during the fall term of second year. A two-week Geological Engineering field school is held in the spring immediately following final exams. Students are expected to take this course at the end of their second year. This course requires teams of students to design and carry out geological and engineering site investigations related to specific geological engineering problems. Core field courses in fourth year deal either with engineering and design issues related to geo-environmental, geotechnical and resource management issues within the mineral industry, or with engineering site investigation design using applied geophysics.

**The cost of field trips and courses, including transportation, accommodation and food (when it is supplied), will be borne by the student. A list of the field education costs for each course is provided on the departmental web page (<http://www.queensu.ca/geol/undergrad/field-trips>).**

**These costs are subject to change, and will be finalized by June 1 each year for the following academic year. These costs will be payable by the due dates listed in the table. Subsidies will be provided by the Department when funding permits.**

Students may incur additional field trip costs for courses they elect to take as a part of their degree. Students should consult with course instructors regarding these costs before registering in courses with a field trip component.

### **Geological Engineering, B.A.Sc. (Class of 2020)**

#### **Second Year CORE – 2017-2018**

- CHEE 209 Analysis of Process Data F | 3.5
- CIVL 230 Solid Mechanics I F | 4.25
- GEOE 207 History of Life F | 3.5
- GEOE 221 Geological Engineering Field Methods F | 5
- GEOE 232 Mineralogy F | 4.5
- GEOE 281 Earth Systems Engineering F | 4
- APSC 221 Economics and Business Practices in Engineering F/W/S | 3 \*
- APSC 200 Engineering Design and Practice II F/W | K4 \*
- APSC 293 Engineering Communications I F/W | K1 \*
- GEOE 235 Genesis and Characterization of Solid Earth Materials W | 4
- GEOE 238 Surficial Processes, Sedimentation and Stratigraphy W | 4
- GEOE 249 Geophysical Characterization of the Earth W | 3.5
- MTHE 225 Ordinary Differential Equations F/W/S-OL | 3.5 \*

\*Note: Students in GEOE take APSC 221, APSC 200, 293 and MTHE 225 in the Winter term.

**Minimum Units: 47.75**

#### **Intersession (Taken in Spring following 2nd Year)**

- GEOE 300 Geological Engineering Field School S | K4

### Third Year CORE – 2018-2019

- GEOE 321 Analysis of Rock Structures F | 4
- CIVL 340 Geotechnical Engineering I F | 3.75
- CIVL 371 Groundwater Engineering F | 3.75
- GEOE 365 Geochemical Characterization of the Earth F | 4
- GEOE 313 Geomechanics and Engineering Geology W | 4
- GEOE 319 Applied Geophysics W | 4.5
- GEOE 333 Terrain Evaluation W | 4
- GEOE 359 Applied Quantitative Analysis in Geological Engineering F | 3.5
- GEOE 362 Resource Engineering W | 4.5
- GEOE 345 Site Investigation & Geological Engineering Design W | 4
- Technical Elective F/W | 3.5

Minimum Units: 47.5

### Fourth Year CORE - 2019-2020

GEOE 410 or GEOE 419 will be taken prior to the start of fourth year at the end of August

**Take ONE of GEOE 410 or GEOE 419 as Core (\* below)**

- GEOE 410 Geological Engineering Field School F | K4 \*
- GEOE 419 Engineering Geophysics Field School S | K4 \*
- GEOE 446 Engineering Design Project I F | K4
- GEOE 447 Engineering Design Project II W | K5.5
- Technical Elective F/W | 3.5
- Technical Elective F/W | 3.5
- Technical Elective F/W | 3.5
- Technical Elective F/W | 3.5
- Complementary Studies Elective F/W | 3
- Complementary Studies Elective F/W | 3
- Complementary Studies Elective F/W | 3

Minimum Units: 36.5

### Electives (Class of 2020)

The Geological Engineering student requires a total of 17.5 TECHNICAL ELECTIVE (TE) CREDITS (210 AUs). These are typically, (but not exclusively) taken as 5 TE elective courses with a minimum average of 3.5 Credits or 42 AUs per course. These courses can be taken at any point during the program to accommodate timetabling but normally only in third and fourth year. Students should plan to ensure that prerequisite and corequisite requirements are met for the full suite of TE or CS electives they wish to take during their program. Students should note that a reduction of total course load to less than 80% of the normal load may prevent them from holding Queen's University scholarships.

It is mandatory that at least 3.5 Credits of Technical Electives (TE) be taken from the following list: APSC 381, APSC 480, CIVL 215, CIVL 250, CIVL 341, CIVL 443, CIVL 471, GEOE 413, GEOE 462, MECH 270, MINE 321, or MINE 469.

Geological Engineering: Technical Electives

## Complementary Studies

Refer to the Complementary Studies section of this calendar for courses that may be taken for all Engineering programs. For the Geological Engineering Program, the Engineering Economics course is APSC 221, and the Communications course is APSC 293 in addition to first year program and the three Complementary Studies courses (as above): 2 from List A and 1 from Lists A,B,C, or D.

### **Geological Engineering, B.A.Sc. (Class of 2021)**

#### Second Year CORE 2018-2019

- CHEE 209 Analysis of Process Data F | 3.5
- CIVL 230 Solid Mechanics I F | 4.25
- GEOE 207 History of Life F | 3.5
- GEOE 221 Geological Engineering Field Methods F | 5
- GEOE 232 Mineralogy F | 4.5
- GEOE 281 Earth Systems Engineering F | 4
- APSC 221 Economics and Business Practices in Engineering F/W/S | 3 \*
- APSC 200 Engineering Design and Practice II F/W | K4 \*
- APSC 293 Engineering Communications I F/W | K1 \*
- GEOE 235 Genesis and Characterization of Solid Earth Materials W | 4
- GEOE 238 Surficial Processes, Sedimentation and Stratigraphy W | 4
- GEOE 249 Geophysical Characterization of the Earth W | 3.5
- MTHE 225 Ordinary Differential Equations F/W/S-OL | 3.5 \*

\*Note: Students in GEOE take APSC 221, APSC 200, APSC 293 and MTHE 225 in the Winter term

Minimum Units: 47.75

#### Intersession (Taken at the end of August before 3rd Year)

- GEOE 300 Geological Engineering Field School S | K4

#### Third Year CORE 2019-2020

- GEOE 321 Analysis of Rock Structures F | 4
- CIVL 340 Geotechnical Engineering I F | 3.75

- CIVL 371 Groundwater Engineering F | 3.75
- GEOE 365 Geochemical Characterization of the Earth F | 4
- GEOE 313 Geomechanics and Engineering Geology W | 4
- GEOE 319 Applied Geophysics W | 4.5
- GEOE 333 Terrain Evaluation W | 4
- GEOE 359 Applied Quantitative Analysis in Geological Engineering F | 3.5
- GEOE 362 Resource Engineering W | 4.5
- GEOE 345 Site Investigation & Geological Engineering Design W | 4
- Technical Elective F/W | 3.5

Minimum Units: 47.5

#### Fourth Year CORE 2020-2021

GEOE 410 or GEOE 419 will be taken prior to the start of fourth year at the end of August

**Take ONE of GEOE 410 or GEOE 419 as Core (\* below)**

- GEOE 410 Geological Engineering Field School F | K4 \*
- GEOE 419 Engineering Geophysics Field School S | K4 \*
- GEOE 446 Engineering Design Project I F | K4
- GEOE 447 Engineering Design Project II W | K5.5
- Technical Elective F/W | 3.5
- Technical Elective F/W | 3.5
- Technical Elective F/W | 3.5
- Technical Elective F/W | 3.5
- CS Elective F/W | 3
- CS Elective F/W | 3
- CS Elective F/W | 3

Minimum Units: 36.5

#### Electives (Classes of 2021)

The Geological Engineering student requires a total of 17.5 TECHNICAL ELECTIVE (TE) CREDITS (210 AUs). These are typically, (but not exclusively) taken as 5 TE elective courses with a minimum average of 3.5 Credits or 42 AUs per course. These courses can be taken at any point during the program to accommodate timetabling but normally only in third and fourth year. Students should plan to ensure that prerequisite and corequisite requirements are met for the full suite of TE or CS electives they wish to take during their program. Students should note that a reduction of total course load to less than 80% of the normal load may prevent them from holding Queen's University scholarships.

It is mandatory that at least 3.5 Credits of Technical Electives (TE) be taken from the following list: APSC 381, APSC 480, CIVL 215, CIVL 250, CIVL 341, CIVL 443, CIVL 471, GEOE 413, GEOE 462, MECH 270, MINE 321, or MINE 469.

Geological Engineering: Technical Electives

## Complementary Studies

Refer to the Complementary Studies section of this calendar for courses that may be taken for all Engineering programs. For the Geological Engineering Program, the Engineering Economics course is APSC 221, and the Communications course is APSC 293 in addition to first year program and the three Complementary Studies courses (as above): 2 from List A and 1 from Lists A,B,C, or D.

### **Geological Engineering, B.A.Sc. (Class of 2022)**

#### Second Year CORE 2019-2020

- APSC 200 Engineering Design and Practice II F/W | K4 \*
- APSC 221 Economics and Business Practices in Engineering F/W/S | 3 \*
- APSC 293 Engineering Communications I F/W | K1 \*
- CHEE 209 Analysis of Process Data F | 3.5
- CIVL 230 Solid Mechanics I F | 4.25
- GEOE 207 History of Life F | 3.5
- GEOE 221 Geological Engineering Field Methods F | 5
- GEOE 232 Mineralogy F | 4.5
- GEOE 235 Genesis and Characterization of Solid Earth Materials W | 4
- GEOE 238 Surficial Processes, Sedimentation and Stratigraphy W | 4
- GEOE 249 Geophysical Characterization of the Earth W | 3.5
- GEOE 281 Earth Systems Engineering F | 4
- MTHE 225 Ordinary Differential Equations F/W/S-OL | 3.5 \*

\*Note: Students in GEOE take APSC 221, APSC 200, APSC 293 and MTHE 225 in the Winter term.

Minimum Units: 47.75

#### Intersession (Taken at the end of August before 3rd year)

- GEOE 300 Geological Engineering Field School S | K4

#### Third Year CORE 2020-2021

- CIVL 340 Geotechnical Engineering I F | 3.75
- CIVL 371 Groundwater Engineering F | 3.75
- GEOE 313 Geomechanics and Engineering Geology W | 4
- GEOE 319 Applied Geophysics W | 4.5
- GEOE 321 Analysis of Rock Structures F | 4
- GEOE 333 Terrain Evaluation W | 4
- GEOE 345 Site Investigation & Geological Engineering Design W | 4
- GEOE 359 Applied Quantitative Analysis in Geological Engineering F | 3.5
- GEOE 362 Resource Engineering W | 4.5
- GEOE 365 Geochemical Characterization of the Earth F | 4
- Technical Elective F/W | 3.5

Minimum Units: 47.5



## Fourth Year CORE 2021-2022

GEOE 410 or GEOE 419 will be taken prior to the start of fourth year at the end of August

### **Take ONE of GEOE 410 or GEOE 419 as Core (\* below)**

- GEOE 410 Geological Engineering Field School F | K4 \*
- GEOE 419 Engineering Geophysics Field School S | K4 \*
- GEOE 446 Engineering Design Project I F | K4
- GEOE 447 Engineering Design Project II W | K5.5
- Technical Elective F/W | 3.5
- Technical Elective F/W | 3.5
- Technical Elective F/W | 3.5
- Technical Elective F/W | 3.5
- Complementary Studies Elective F/W | 3
- Complementary Studies Elective F/W | 3
- Complementary Studies Elective F/W | 3

Minimum Units: 36.5

### Electives (Class of 2022)

The Geological Engineering student requires a total of 17.5 TECHNICAL ELECTIVE (TE) CREDITS (210 AUs). These are typically, (but not exclusively) taken as 5 TE elective courses with a minimum average of 3.5 Credits or 42 AUs per course. These courses can be taken at any point during the program to accommodate timetabling but normally only in third and fourth year. Students should plan to ensure that prerequisite and corequisite requirements are met for the full suite of TE or CS electives they wish to take during their program. Students should note that a reduction of total course load to less than 80% of the normal load may prevent them from holding Queen's University scholarships.

It is mandatory that at least 3.5 Credits of Technical Electives (TE) be taken from the following list: APSC 381, APSC 480, CIVL 215, CIVL 250, CIVL 341, CIVL 443, CIVL 471, GEOE 413, GEOE 462, MECH 270, MINE 321, or MINE 469.

Geological Engineering: Technical Electives

### Complementary Studies

Refer to the Complementary Studies section of this calendar for courses that may be taken for all Engineering programs. For the Geological Engineering Program, the Engineering Economics course is APSC 221, and the Communications course is APSC 293 in addition to first year program and the three Complementary Studies courses (as above): 2 from List A and 1 from Lists A,B,C, or D.

### **Geological Engineering: Technical Electives**

All courses on this list can be counted as Technical Elective unless they have already been taken as core. Some of these elective courses may not be available to all students due to prerequisite course requirements. Some courses are offered in alternating years. The student is responsible for confirming that he/she has the necessary prerequisites or permission of the instructor. For some courses that are part of other program cores and subject to internal enrollment restrictions, permission of the instructor may be required even if prerequisites are met. Other technical courses (courses with level 200+ that do not appear in the complimentary studies list for APSC) may be considered as eligible Technical Electives with the permission of the GEOE academic advisor and GEOE curriculum chair, and if the instructor of the course permits the student to register. In addition, see the APSC section of the course descriptions for information on APSC30#: "Professional Internships".

## Technical Electives List

- APSC 250 Biology Through an Engineering Lens S/OL | K3.5
- APSC 381 Advanced Design and Skills for Innovation W | K3.5
- APSC 480 Multi-disciplinary Industry Engineering Design Project FW | K9
- CHEE 324 Organic Process Development W | 3.5
- CHEE 371 Mitigation of Industrial Pollution W | 3.5
- CHEE 400 DELETED Technology, Engineering & Management (TEAM) FW | K7
- CIVL 215 Materials for Civil Engineers W | 4.5
- CIVL 231 Solid Mechanics II W | 4.5
- CIVL 350 Hydraulics II F | 3.75
- CIVL 340 Geotechnical Engineering I F | 3.75
- CIVL 341 Geotechnical Engineering II W | 4
- CIVL 443 Geoenvironmental Design W | 4
- CIVL 451 Lake, Reservoir and Coastal Engineering F | 3.75
- CIVL 471 Subsurface Contamination W | 4
- CHEE 484 NOT OFFERED 2019-2020 Bioremediation W | 3.5
- CMPE 320 Fundamentals of Software Development F | 4
- ELEC 210 DELETED Introductory Electric Circuits and Machines W | 4.25
- ELEC 221 Electric Circuits F | 4.25
- ELEC 278 Fundamentals of Information Structures F | 4
- ELEC 279 Introduction to Object Oriented Programming W | 4
- ELEC 280 Fundamentals of Electromagnetics W | 3.75
- ELEC 381 Applications of Electromagnetics F | 3.75
- ENCH 213 Introduction to Chemical Analysis F | 4.5
- ENPH 225 Mechanics W | 3.5
- ENPH 239 Electricity and Magnetism W | 3.5
- ENPH 334 Electronics for Applied Scientists F | 5
- GEOE 301 Field Studies in Geology F | 1.5
- GEOE 337 Paleontology F | 3.75
- GEOE 340 Problems in Geological Engineering F/W | 3
- GEOE 341 Special Topics in Applied Geology S | 3
- GEOE 343 NOT OFFERED THIS YEAR-Applied Hydrogeology F | 3.75
- GEOE 368 Carbonate Sedimentology F | 4.5
- GEOE 401 Field Studies in Geology II F | 1.5
- GEOE 410 Geological Engineering Field School F | K4
- GEOE 414 Foundations of the Oil and Gas Industry W | 3.5
- GEOE 418 Petroleum Geology F | 4.5

- GEOE 419 Engineering Geophysics Field School S | K4
- GEOE 439 Advanced Applied Geophysics F | K3
- GEOE 452 Instrumental Techniques Applied to the Study of Solids W | 3
- GEOE 462 Advanced Petrogenesis and Metallogenesis W | 4.5
- GEOE 463 Spatial Information Management in the Geosciences F | 3.5
- GEOE 464 Visualization in Geosciences W | 1.5
- GEOE 466 Isotopes and the Environment W | 4
- GEOE 475 Exploration and Environmental Geochemistry F | 4.3
- GEOE 478 Terrigenous Clastic Sedimentology F | 3.5
- GEOE 481 Structural Analysis Applied to Resource Deposits W | 3.5
- GEOE 488 Geology of North America F | 3
- GPHY 304 Arctic and Periglacial Environments W | 3
- MINE 321 Drilling and Blasting F | 4.5
- MINE 422 Mining and Sustainability F | 4
- MINE 451 Chemical Extraction of Metals F | 3
- MINE 467 Geostatistics and Orebody Modelling F | 4.5
- MINE 469 Stability Analysis in Mine Design F | 4
- MTHE 227 Vector Analysis F | 3
- MTHE 228 Complex Analysis W | 3.5
- MTHE 339 Evolutionary Game Theory F | 3
- ENPH 242 Relativity and Quanta F | 3.5
- MECH 228 Kinematics and Dynamics W | K3.5
- MECH 230 Thermodynamics I F | 3.5
- MECH 270 Materials Science and Engineering F | 3.5
- MINE 459 Risk and Reliability Analysis for Industrial Asset Management, Health & Safety F | 4

## Mathematics and Engineering

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**Chair of Undergraduate Studies** A. Mansouri

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This plan was developed at Queen's in response to the need for engineers who possess the skills and insights of applied mathematicians. In the second and third years of the plan, half of the curriculum consists of honours courses in pure and applied mathematics; the balance consists of engineering courses in one of three sub-plans offered in cooperation with the departments of Mechanical, Electrical and Computer Engineering, and the School of Computing. The sub-plans are developed with appropriate applications of mathematics to engineering in the final year. The sub-plans are:

(M6) APPLIED MECHANICS: (mechanics, dynamics, fluid mechanics, thermodynamics)

(M9) COMPUTING AND COMMUNICATIONS: (computer science, software design, communication, information systems, and electrical engineering)

(M11) SYSTEMS AND ROBOTICS: (electrical and mechanical engineering, control, communications, information systems, robotics, and mechanics)

Options available:

- Applied Mechanics Option
- Computing and Communications Option
- Systems and Robotics Option

### **Mathematics and Engineering, B.A.Sc. (Class of 2020)**

#### **Second Year Common Core - 2017/2018**

- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- MTHE 217 Algebraic Structures with Applications F | 3.5
- MTHE 237 Differential Equations for Engineering Science F | 3.25
- MTHE 280 Advanced Calculus F | 3.5
- MTHE 212 Linear Algebra W | 3.5
- MTHE 281 Introduction to Real Analysis W | 3.5

#### **Applied Mechanics Sub-Plan (M6)**

- MECH 221 Solid Mechanics I F, O/L | 4
- MECH 230 Thermodynamics I F | 3.5
- ENPH 252 Management of Experimental Data W | 1.25
- ELEC 210 DELETED Introductory Electric Circuits and Machines W | 4.25
- MECH 228 Kinematics and Dynamics W | K3.5
- MECH 241 Fluid Mechanics I W/S-OL | 3.5

Minimum Total Credits: 42.25

#### **Computing and Communications Sub-Plan (M9)**

- ELEC 271 Digital Systems F | 4
- ELEC 274 Computer Architecture W | 4
- CMPE 212 Introduction to Computing Science II F/W | 4
- ELEC 278 Fundamentals of Information Structures F | 4
- ENPH 239 Electricity and Magnetism W | 3.5

Minimum Total Credits: 42

#### **Systems and Robotics Sub-Plan (M11)**

- ELEC 221 Electric Circuits F | 4.25
- ELEC 271 Digital Systems F | 4
- ENPH 225 Mechanics W | 3.5
- ELEC 252 Electronics I W | 4.25
- ELEC 274 Computer Architecture W | 4

Minimum Total Credits: 42.5

### Third Year Common Core - 2018/2019

- MTHE 326 Functions of a Complex Variable F | 3.5
- MTHE 332 Introduction to Control W | 4
- MTHE 334 Mathematical Methods for Engineering and Physics F | 3.5
- MTHE 335 Mathematics of Engineering Systems W | 3.5
- MTHE 393 Engineering Design and Practice for Mathematics and Engineering W | K4
- APSC 221 Economics and Business Practices in Engineering F/W/S | 3

### Applied Mechanics Sub-Plan (M6)

- MECH 321 Solid Mechanics II F | 3.5
- MECH 328 Dynamics and Vibration F | 3.5
- MECH 330 Applied Thermodynamics II F | 3.5
- MECH 398 Mechanical Engineering Laboratory I F | K2
- MECH 323 Machine Design W | 4.5
- MECH 341 Fluid Mechanics II W | 3.5
- MECH 399 Mechanical Engineering Laboratory II W | K2

Minimum Total Credits: 45

### Computing and Communications Sub-Plan (M9)

- ELEC 221 Electric Circuits F | 4.25
- ELEC 371 Microprocessor Interfacing and Embedded Systems F | 4
- MTHE 351 Probability I F | 3.5
- Complementary Studies, List A F/W | 3
- ELEC 252 Electronics I W | 4.25
- MTHE 353 Probability II W | 3

Minimum Total Credits: 43.5

### Systems and Robotics Sub-Plan (M11)

- MTHE 351 Probability I F | 3.5
- ELEC 278 Fundamentals of Information Structures F | 4
- ELEC 371 Microprocessor Interfacing and Embedded Systems F | 4
- Complementary Studies, List A F | 3
- ENPH 239 Electricity and Magnetism W | 3.5
- MTHE 353 Probability II W | 3

Minimum Total Credits: 42.5

### Fourth Year Common Core - 2019/2020

- MTHE 494 Mathematics and Engineering Seminar F | 3
- MTHE 493 Engineering Mathematics Project FW\* | K7.5

### Applied Mechanics Sub-Plan (M6)

- MTHE 430 Modern Control Theory F | 4
- MTHE 351 Probability I F | 3.5
- Complementary Studies, List A F/W | 3
- Complementary Studies, List A F/W | 3
- Complementary Studies, List A, B, C, or D W | 3
- MTHE 439 Lagrangian Mechanics, Dynamics, and Control W | 3.5

#### Electives

M6 students must choose 4 technical electives: a minimum of one (1) technical elective must be taken from List I; and the remaining from List II, subject to the requirement that the elective selection satisfies the following two criteria:

1. the selection exceeds the minimum of 40 Accreditation Units (AUs) in Engineering Design (ED) and
2. the selection exceeds the minimum of 120 AUs in Engineering Design + Engineering Science (ES+ED).

**PLEASE NOTE:** the term in which a course is offered can change from one academic year to the next. This can occur due to instructor availability or a change to departmental resources. Please refer to the on-line Course Timetable to determine the terms in which the courses in this Technical Elective section will be offered.

Mathematics and Engineering, Applied Mechanics (M6): Technical Electives

Minimum Total Credits: 42.5

### Computing and Communications Sub-Plan (M9)

- CMPE 365 Algorithms I F | 4
- MTHE 474 Information Theory F | 3
- MTHE 455 Stochastic Processes and Applications F | 3.5
- Complementary Studies, List A F/W | 3
- Complementary Studies, List A, B, C or D F/W | 3
- MTHE 477 Data Compression and Source Coding W | 3

#### Electives

M9 students must choose 4 technical electives: a minimum of one (1) technical elective must be taken from List I; and the remaining from List II, subject to the requirement that the elective selection satisfies the following two criteria:

1. the selection exceeds the minimum of 40 Accreditation Units (AUs) in Engineering Design (ED) and
2. the selection exceeds the minimum of 100 AUs in Engineering Design + Engineering Science (ES+ED).

**PLEASE NOTE:** the term in which a course is offered can change from one academic year to the next. This can occur due to instructor availability or a change to departmental resources. Please refer to the on-line Course Timetable to determine the terms in which the courses in this Technical Elective section will be offered.

Mathematics and Engineering, Computing and Communications (M9): Technical Electives

Minimum Total Credits: 42

### Systems and Robotics Sub-Plan (M11)

- MTHE 430 Modern Control Theory F | 4
- MTHE 474 Information Theory F | 3
- MTHE 472 Control of Stochastic Systems W | 3
- Complementary Studies, List A F/W | 3
- Complementary Studies, List A, B, C or D F/W | 3

### Electives

M11 students must choose 4 technical electives: a minimum of one (1) technical elective must be taken from List I; and the remaining from List II, subject to the requirement that the elective selection satisfies the following two criteria:

1. the selection exceeds the minimum of 40 Accreditation Units (AUs) in Engineering Design (ED) and
2. the selection exceeds the minimum of 120 AUs in Engineering Design + Engineering Science (ES+ED).

**PLEASE NOTE:** the term in which a course is offered can change from one academic year to the next. This can occur due to instructor availability or a change to departmental resources. Please refer to the on-line Course Timetable to determine the terms in which the courses in this Technical Elective section will be offered.

Mathematics and Engineering, Systems and Robotics (M11): Technical Electives

Minimum Total Credits: 38.5

### Complementary Studies

Refer to the Complementary Studies section of this calendar for details regarding the requirements for all Engineering programs. For the Mathematics and Engineering Program, the Engineering Economics course is APSC 221, and the Communications requirements are met through courses taken in the core program (MTHE 393, MTHE 494, MTHE 493 and APSC 293).

### Mathematics and Engineering, B.A.Sc. (Class of 2021)

#### Second Year Common Core - 2018/2019

- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- MTHE 217 Algebraic Structures with Applications F | 3.5
- MTHE 237 Differential Equations for Engineering Science F | 3.25
- MTHE 280 Advanced Calculus F | 3.5
- MTHE 281 Introduction to Real Analysis W | 3.5
- MTHE 212 Linear Algebra W | 3.5

### Applied Mechanics Sub-Plan (M6)

- MECH 221 Solid Mechanics I F, O/L | 4

- MECH 230 Thermodynamics I F | 3.5
- ENPH 252 Management of Experimental Data W | 1.25
- ELEC 210 DELETED Introductory Electric Circuits and Machines W | 4.25
- MECH 228 Kinematics and Dynamics W | K3.5
- MECH 241 Fluid Mechanics I W/S-OL | 3.5

Minimum Total Credits: 42.25

### Computing and Communications Sub-Plan (M9)

- ELEC 271 Digital Systems F | 4
- ELEC 274 Computer Architecture W | 4
- ENPH 239 Electricity and Magnetism W | 3.5
- CMPE 212 Introduction to Computing Science II F/W | 4
- ELEC 278 Fundamentals of Information Structures F | 4

Minimum Total Credits: 42

### Systems and Robotics Sub-Plan (M11)

- ELEC 221 Electric Circuits F | 4.25
- ELEC 271 Digital Systems F | 4
- ENPH 225 Mechanics W | 3.5
- ELEC 252 Electronics I W | 4.25
- ELEC 274 Computer Architecture W | 4

Minimum Total Credits: 42.5

### Third Year Common Core - 2019/2020

- MTHE 326 Functions of a Complex Variable F | 3.5
- MTHE 332 Introduction to Control W | 4
- MTHE 334 Mathematical Methods for Engineering and Physics F | 3.5
- MTHE 335 Mathematics of Engineering Systems W | 3.5
- MTHE 393 Engineering Design and Practice for Mathematics and Engineering W | K4
- APSC 221 Economics and Business Practices in Engineering F/W/S | 3

### Applied Mechanics Sub-Plan (M6)

- MECH 321 Solid Mechanics II F | 3.5
- MECH 328 Dynamics and Vibration F | 3.5
- MECH 330 Applied Thermodynamics II F | 3.5
- MECH 398 Mechanical Engineering Laboratory I F | K2
- MECH 323 Machine Design W | 4.5
- MECH 341 Fluid Mechanics II W | 3.5
- MECH 399 Mechanical Engineering Laboratory II W | K2



Minimum Total Credits: 44

### Computing and Communications Sub-Plan (M9)

- ELEC 221 Electric Circuits F | 4.25
- ELEC 371 Microprocessor Interfacing and Embedded Systems F | 4
- MTHE 351 Probability I F | 3.5
- Complementary Studies, List A F/W | 3
- ELEC 252 Electronics I W | 4.25
- MTHE 353 Probability II W | 3

Minimum Total Credits: 43.5

### Systems and Robotics Sub-Plan (M11)

- MTHE 351 Probability I F | 3.5
- ELEC 278 Fundamentals of Information Structures F | 4
- ELEC 371 Microprocessor Interfacing and Embedded Systems F | 4
- Complementary Studies, List A F | 3
- ENPH 239 Electricity and Magnetism W | 3.5
- MTHE 353 Probability II W | 3

Minimum Total Credits: 42.5

### Fourth Year Common Core - 2020/2021

- MTHE 494 Mathematics and Engineering Seminar F | 3
- MTHE 493 Engineering Mathematics Project FW\* | K7.5

### Applied Mechanics Sub-Plan (M6)

- MTHE 430 Modern Control Theory F | 4
- MTHE 351 Probability I F | 3.5
- Complementary Studies, List A F/W | 3
- Complementary Studies, List A F/W | 3
- Complementary Studies, List A, B, C, or D W | 3
- MTHE 439 Lagrangian Mechanics, Dynamics, and Control W | 3.5

### Elective

M6 students must choose 4 technical electives: a minimum of one (1) technical elective must be taken from List I; and the remaining from List II, subject to the requirement that the elective selection satisfies the following two criteria:

1. the selection exceeds the minimum of 40 Accreditation Units (AUs) in Engineering Design (ED) and
2. the selection exceeds the minimum of 120 AUs in Engineering Design + Engineering Science (ES+ED).

**PLEASE NOTE:** the term in which a course is offered can change from one academic year to the next. This can occur due to instructor availability or a change to departmental resources. Please refer to the on-line Course Timetable to determine the terms in which the courses in this Technical Elective section will be offered.

Mathematics and Engineering, Applied Mechanics (M6): Technical Electives

Minimum Total Credits: 42.5

### Computing and Communications Sub-Plan (M9)

- CMPE 365 Algorithms I F | 4
- MTHE 474 Information Theory F | 3
- MTHE 455 Stochastic Processes and Applications F | 3.5
- Complementary Studies, List A F/W | 3
- Complementary Studies, List A, B, C or D F/W | 3
- MTHE 477 Data Compression and Source Coding W | 3

#### Elective

M9 students must choose 4 technical electives: a minimum of one (1) technical elective must be taken from List I; and the remaining from List II, subject to the requirement that the elective selection satisfies the following two criteria:

1. the selection exceeds the minimum of 40 Accreditation Units (AUs) in Engineering Design (ED) and
2. the selection exceeds the minimum of 100 AUs in Engineering Design + Engineering Science (ES+ED).

**PLEASE NOTE:** *the term in which a course is offered can change from one academic year to the next. This can occur due to instructor availability or a change to departmental resources. Please refer to the on-line Course Timetable to determine the terms in which the courses in this Technical Elective section will be offered.*

Mathematics and Engineering, Computing and Communications (M9): Technical Electives

Minimum Total Credits: 42

### Systems and Robotics Sub-Plan (M11)

- MTHE 430 Modern Control Theory F | 4
- MTHE 472 Control of Stochastic Systems W | 3
- MTHE 474 Information Theory F | 3
- Complementary Studies, List A F/W | 3
- Complementary Studies, List A, B, C or D F/W | 3

#### Elective

M11 students must choose 4 technical electives: a minimum of one (1) technical elective must be taken from List I; and the remaining from List II, subject to the requirement that the elective selection satisfies the following two criteria:

1. the selection exceeds the minimum of 40 Accreditation Units (AUs) in Engineering Design (ED) and
2. the selection exceeds the minimum of 120 AUs in Engineering Design + Engineering Science (ES+ED).

**PLEASE NOTE:** *the term in which a course is offered can change from one academic year to the next. This can occur due to instructor availability or a change to departmental resources. Please refer to the on-line Course Timetable to determine the terms in which the courses in this Technical Elective section will be offered.*

Mathematics and Engineering, Systems and Robotics (M11): Technical Electives

Minimum Total Credits: 38.5

## Complementary Studies

*Refer to the Complementary Studies section of this calendar for details regarding the requirements for all Engineering programs. For the Mathematics and Engineering Program, the Engineering Economics course is APSC 221, and the Communications requirements are met through courses taken in the core program (MTHE 393, MTHE 494, MTHE 493 and APSC 293*

## Mathematics and Engineering, B.A.Sc. (Class of 2022)

### Second Year CORE 2019/2020

- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- MTHE 212 Linear Algebra W | 3.5
- MTHE 217 Algebraic Structures with Applications F | 3.5
- MTHE 237 Differential Equations for Engineering Science F | 3.25
- MTHE 280 Advanced Calculus F | 3.5
- MTHE 281 Introduction to Real Analysis W | 3.5

### Applied Mechanics Sub-Plan (M6)

- ENPH 252 Management of Experimental Data W | 1.25
- MECH 210 Electronic Circuits and Motors for Mechatronics W | K4.5
- MECH 221 Solid Mechanics I F, O/L | 4
- MECH 228 Kinematics and Dynamics W | K3.5
- MECH 230 Thermodynamics I F | 3.5
- MECH 241 Fluid Mechanics I W/S-OL | 3.5

Minimum Total Credits: 42.5

### Computing and Communications Sub-Plan (M9)

- CMPE 212 Introduction to Computing Science II F/W | 4
- ELEC 271 Digital Systems F | 4
- ELEC 274 Computer Architecture W | 4
- ELEC 278 Fundamentals of Information Structures F | 4
- ENPH 239 Electricity and Magnetism W | 3.5

Minimum Total Credits: 41.75

### Systems and Robotics Sub-Plan (M11)

- ELEC 221 Electric Circuits F | 4.25

- ELEC 252 Electronics I W | 4.25
- ELEC 271 Digital Systems F | 4
- ELEC 274 Computer Architecture W | 4
- ENPH 225 Mechanics W | 3.5

Minimum Total Credits: 42.25

### Third Year CORE 2020/2021

- APSC 221 Economics and Business Practices in Engineering F/W/S | 3
- MTHE 326 Functions of a Complex Variable F | 3.5
- MTHE 332 Introduction to Control W | 4
- MTHE 334 Mathematical Methods for Engineering and Physics F | 3.5
- MTHE 335 Mathematics of Engineering Systems W | 3.5
- MTHE 393 Engineering Design and Practice for Mathematics and Engineering W | K4

### Applied Mechanics Sub-Plan (M6)

- MECH 321 Solid Mechanics II F | 3.5
- MECH 323 Machine Design W | 4.5
- MECH 328 Dynamics and Vibration F | 3.5
- MECH 330 Applied Thermodynamics II F | 3.5
- MECH 341 Fluid Mechanics II W | 3.5
- MECH 398 Mechanical Engineering Laboratory I F | K2
- MECH 399 Mechanical Engineering Laboratory II W | K2

Minimum Total Credits: 44

### Computing and Communications Sub-Plan (M9)

- ELEC 221 Electric Circuits F | 4.25
- ELEC 252 Electronics I W | 4.25
- ELEC 371 Microprocessor Interfacing and Embedded Systems F | 4
- MTHE 351 Probability I F | 3.5
- MTHE 353 Probability II W | 3
- Complementary Studies, List A F/W | 3

Minimum Total Credits: 43.5

### Systems and Robotics Sub-Plan (M11)

- ELEC 278 Fundamentals of Information Structures F | 4
- ELEC 371 Microprocessor Interfacing and Embedded Systems F | 4
- ENPH 239 Electricity and Magnetism W | 3.5
- MTHE 351 Probability I F | 3.5
- MTHE 353 Probability II W | 3

- Complementary Studies, List A F | 3

Minimum Total Credits: 42.5

#### Fourth Year CORE 2021/2022

- MTHE 493 Engineering Mathematics Project FW\* | K7.5
- MTHE 494 Mathematics and Engineering Seminar F | 3

#### Applied Mechanics Sub-Plan (M6)

- MTHE 351 Probability I F | 3.5
- MTHE 430 Modern Control Theory F | 4
- MTHE 439 Lagrangian Mechanics, Dynamics, and Control W | 3.5
- Complementary Studies, List A F/W | 3
- Complementary Studies, List A F/W | 3
- Complementary Studies, List A, B, C, or D W | 3

#### Electives

M6 students must choose 4 technical electives: a minimum of one (1) technical elective must be taken from List I; and the remaining from List II, subject to the requirement that the elective selection satisfies the following two criteria:

1. the selection exceeds the minimum of 40 Accreditation Units (AUs) in Engineering Design (ED) and
2. the selection exceeds the minimum of 120 AUs in Engineering Design + Engineering Science (ES+ED).

**PLEASE NOTE:** the term in which a course is offered can change from one academic year to the next. This can occur due to instructor availability or a change to departmental resources. Please refer to the on-line Course Timetable to determine the terms in which the courses in this Technical Elective section will be offered.

Mathematics and Engineering, Applied Mechanics (M6): Technical Electives

Minimum Total Credits: 42.5

#### Computing and Communications Sub-Plan (M9)

- CMPE 365 Algorithms I F | 4
- MTHE 455 Stochastic Processes and Applications F | 3.5
- MTHE 474 Information Theory F | 3
- MTHE 477 Data Compression and Source Coding W | 3
- Complementary Studies, List A F/W | 3
- Complementary Studies, List A, B, C or D F/W | 3

#### Electives

M9 students must choose 4 technical electives: a minimum of one (1) technical elective must be taken from List I; and the remaining from List II, subject to the requirement that the elective selection satisfies the following two criteria:

1. the selection exceeds the minimum of 40 Accreditation Units (AUs) in Engineering Design (ED) and

2. the selection exceeds the minimum of 100 AUs in Engineering Design + Engineering Science (ES+ED).

**PLEASE NOTE:** the term in which a course is offered can change from one academic year to the next. This can occur due to instructor availability or a change to departmental resources. Please refer to the on-line Course Timetable to determine the terms in which the courses in this Technical Elective section will be offered.

Mathematics and Engineering, Computing and Communications (M9): Technical Electives

Minimum Total Credits: 42

### Systems and Robotics Sub-Plan (M11)

- MTHE 430 Modern Control Theory F | 4
- MTHE 474 Information Theory F | 3
- MTHE 472 Control of Stochastic Systems W | 3
- Complementary Studies, List A F/W | 3
- Complementary Studies, List A, B, C or D F/W | 3

#### Electives

M11 students must choose 4 technical electives: a minimum of one (1) technical elective must be taken from List I; and the remaining from List II, subject to the requirement that the elective selection satisfies the following two criteria:

1. the selection exceeds the minimum of 40 Accreditation Units (AUs) in Engineering Design (ED) and
2. the selection exceeds the minimum of 120 AUs in Engineering Design + Engineering Science (ES+ED).

**PLEASE NOTE:** the term in which a course is offered can change from one academic year to the next. This can occur due to instructor availability or a change to departmental resources. Please refer to the on-line Course Timetable to determine the terms in which the courses in this Technical Elective section will be offered.

Mathematics and Engineering, Systems and Robotics (M11): Technical Electives

Minimum Total Credits: 38.5

### Complementary Studies

Refer to the Complementary Studies section of this calendar for details regarding the requirements for all Engineering programs. For the Mathematics and Engineering Program, the Engineering Economics course is APSC 221, and the Communications requirements are met through courses taken in the core program (MTHE 393, MTHE 494, MTHE 493 and APSC 293)

### Mathematics and Engineering, Applied Mechanics (M6): Technical Electives

#### List I:

*(choose AT LEAST ONE course)*

- MTHE 353 Probability II W | 3
- MTHE 406 NOT OFFERED 2019-2020 - Introduction to Coding Theory F | 3
- MTHE 418 Number Theory and Cryptography F | 3

- MTHE 434 NOT OFFERED 2019-2020 - Optimization Theory with Applications to Machine Learning F | 3.5
- MTHE 472 Control of Stochastic Systems W | 3

List II:

- MECH 346 Heat Transfer W | 3.5
- MECH 420 Vibrations W | 3.5
- MECH 424 Sustainable Product Design F | 3.5
- MECH 435 Internal Combustion Engines W | 3.5
- MECH 439 Turbomachinery F | 3.5
- MECH 441 NOT OFFERED 2019/2020 - Fluid Mechanics III W | 3.5
- MECH 444 Computational Fluid Dynamics F | 3.5
- MECH 448 Compressible Fluid Flow F | 3.5
- MECH 452 Mechatronics Engineering F | 5
- MECH 455 NOT OFFERED 2019-2020 - Computer Integrated Manufacturing F | 3.5
- MECH 456 NOT OFFERED 2019-2020 - Introduction to Robotics F | 3.5
- OR
- ELEC 448 Introduction to Robotics: Mechanics and Control W | 3.5
- MECH 465 Computer-Aided Design F | 3.5
- MECH 480 NOT OFFERED 2019-2020 - Airplane Aerodynamics and Performance W | 3.5
- MECH 482 Noise Control W | 3.5
- MECH 492 Biological Fluid Dynamics F | 3.5
- MECH 494 Kinematics of Human Motion F | 3.5
- MECH 495 Ergonomics and Design W | 3.5
- MECH 496 Musculoskeletal Biomechanics F | 3.5
- MECH 430 NOT OFFERED 2019-2020 Thermal Systems Design W | 4
- MINE 472 Mining Systems, Automation, and Robotics O/L | K3.5

**Mathematics and Engineering, Computing and Communications (M9): Technical Electives**

List I:

*(choose AT LEAST ONE course)*

- MTHE 406 NOT OFFERED 2019-2020 - Introduction to Coding Theory F | 3
- MTHE 418 Number Theory and Cryptography F | 3
- MTHE 430 Modern Control Theory F | 4
- MTHE 434 NOT OFFERED 2019-2020 - Optimization Theory with Applications to Machine Learning F | 3.5
- MTHE 472 Control of Stochastic Systems W | 3
- MTHE 478 NOT OFFERED 2019-2020 - Topics in Communication Theory F/W | 3
- MTHE 484 NOT OFFERED 2019-2020 - Data Networks W | 3
- MTHE 454 NOT OFFERED 2019-2020 - Statistical Spectrum Estimation W | 3

List II:

- CMPE 332 Database Management Systems W | 3
- CMPE 434 NOT OFFERED THIS YEAR: Distributed Systems F | 3
- CMPE 454 Computer Graphics W | 3
- CMPE 457 Image Processing and Computer Vision F | 3
- ELEC 374 Digital Systems Engineering W | 4.25
- ELEC 377 Operating Systems F | 4
- ELEC 421 Digital Signal Processing: Filters and System Design F | 4
- ELEC 422 NOT OFFERED 2019-2020 Digital Signal Processing: Random Models and Applications F | 3
- ELEC 461 NOT OFFERED 2019-2020 Digital Communications F | 3.5
- ELEC 464 Wireless Communications F | 3
- ELEC 470 NOT OFFERED 2019-2020 Computer System Architecture W | 3.5
- ELEC 373 Computer Networks W | 3.5
- SOFT 437 NOT OFFERED 2019-2020 - Performance Analysis W | 3
- CMPE 320 Fundamentals of Software Development F | 4
- CMPE 251 Data Analytics F | 3
- CMPE 351 Advanced Data Analytics W | 3

### **Mathematics and Engineering, Systems and Robotics (M11): Technical Electives**

#### List I:

*(choose AT LEAST ONE course)*

- MTHE 406 NOT OFFERED 2019-2020 - Introduction to Coding Theory F | 3
- MTHE 434 NOT OFFERED 2019-2020 - Optimization Theory with Applications to Machine Learning F | 3.5
- MTHE 439 Lagrangian Mechanics, Dynamics, and Control W | 3.5
- MTHE 477 Data Compression and Source Coding W | 3
- MTHE 478 NOT OFFERED 2019-2020 - Topics in Communication Theory F/W | 3
- MTHE 484 NOT OFFERED 2019-2020 - Data Networks W | 3
- MTHE 454 NOT OFFERED 2019-2020 - Statistical Spectrum Estimation W | 3
- MTHE 455 Stochastic Processes and Applications F | 3.5

#### List II:

- ELEC 353 Electronics II F | 4.25
- ELEC 421 Digital Signal Processing: Filters and System Design F | 4
- ELEC 431 Power Electronics F | 3.25
- ELEC 448 Introduction to Robotics: Mechanics and Control W | 3.5
- OR
- MECH 456 NOT OFFERED 2019-2020 - Introduction to Robotics F | 3.5
- ELEC 454 Analog Electronics W | 3.25
- ELEC 457 NOT OFFERED 2019-2020 Integrated Circuits and System Applications F | 3.25
- ELEC 461 NOT OFFERED 2019-2020 Digital Communications F | 3.5
- ELEC 464 Wireless Communications F | 3
- ELEC 483 NOT OFFERED 2019-2020 Microwave and RF Circuits and Systems W | 4.25



- ELEC 486 Fiber Optic Communications W | 3.75
- MECH 452 Mechatronics Engineering F | 5
- MINE 472 Mining Systems, Automation, and Robotics O/L | K3.5

## Mechanical Engineering

**Department Head:** K. Pilkey

**Chair of Undergraduate Studies:** Darko Matovic (Fall 2019)

**Chair of Undergraduate Studies:** Gene Zak (Winter 2020)

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The second year curriculum is common to all sub-plans, but prior to or during the second year, students select from the following options (sub-plans) for their third year: General (ME1) allows students to select technical electives from a variety of specialized areas of study; Materials (ME2) includes courses in materials and metallurgical engineering; or Biomechanical (ME3) includes courses in the biomechanical field. Note that with the wide variety of courses offered, the Department cannot guarantee all courses are conflict free or offered each calendar year, particularly for students who choose to transfer or change options in their third or fourth year. Transferring programs could also result in extending the length of the program beyond the typical 4 years.

Students are invited to participate in one of the international design competition teams such as the Autonomous Sailboat Team (MAST), Baja SAE Team, Formula SAE Team, SAE Aero Design Team, ECO Vehicle Design Team, Fuel Cell Design Team or the Solar Design Team.

Options available:

- Materials Option
- Biomechanical Option

## Mechanical and Materials Engineering, B.A.Sc. (Class of 2020)

### Second Year Common Core - 2017/18

- MECH 217 Measurement in Mechatronics F | 4.25
- MECH 221 Solid Mechanics I F, O/L | 4
- MTHE 225 Ordinary Differential Equations F/W/S-OL | 3.5
- MECH 213 Manufacturing Methods F | 4.5
- MECH 230 Thermodynamics I F | 3.5
- MECH 270 Materials Science and Engineering F | 3.5
- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- ELEC 210 DELETED Introductory Electric Circuits and Machines W | 4.25
- MTHE 272 NOT OFFERED 2019-2020 - Application of Numerical Methods W | 3.5

- MECH 228 Kinematics and Dynamics W | K3.5
- MECH 241 Fluid Mechanics I W/S-OL | 3.5

### Minimum Total Credits: 43.25

Note: Students should be aware that a transfer or a change in option choice may result in their program requirements taking more than the typical 4 years because of course availability and conflicts in their core timetable. The department cannot guarantee that courses will not conflict when a student changes options or transfers, especially after 2nd year.

MME students normally take APSC 200/293 in the winter term.

### Third Year Common Core - 2018/19

- APSC 221 Economics and Business Practices in Engineering F/W/S | 3
- MECH 321 Solid Mechanics II F | 3.5
- MECH 328 Dynamics and Vibration F | 3.5
- MECH 323 Machine Design W | 4.5
- MECH 346 Heat Transfer W | 3.5
- MECH 350 Automatic Control W | 3.5
- MTHE 367 Engineering Data Analysis W | 3.5
- One Elective Course towards either Technical Elective or Complementary Studies requirements F | 3.0 (typically 3 or more units)

### General Sub-Plan (ME1)

Note: MECH 396 and MECH 397 require MECH 370 and MECH 371 as co-requisites which would be additional courses in the third year for students in the ME1 or ME3 options.

- MECH 330 Applied Thermodynamics II F | 3.5
- MECH 396 Mechanical and Materials Engineering Laboratory I F | K2  
OR
- MECH 398 Mechanical Engineering Laboratory I F | K2
- MECH 341 Fluid Mechanics II W | 3.5
- MECH 397 Mechanical and Materials Engineering Laboratory II W | K2  
OR
- MECH 399 Mechanical Engineering Laboratory II W | K2

Minimum Total Credits: 40.0

### Materials Sub-Plan (ME2)

- MECH 370 Principles of Materials Processing F | 3.5
- MECH 396 Mechanical and Materials Engineering Laboratory I F | K2
- MECH 371 Fracture Mechanics and Dislocation Theory W | 3.5
- MECH 397 Mechanical and Materials Engineering Laboratory II W | K2

Minimum Total Credits: 40.0

### Biomechanical Sub-Plan (ME3)

Note: MECH 396 and MECH 397 require MECH 370 and MECH 371 as co-requisites which would be additional courses in the third year for students in the ME1 or ME3 options.

- MECH 393 Biomechanical Product Development F | 3.5
- MECH 396 Mechanical and Materials Engineering Laboratory I F | K2  
OR
- MECH 398 Mechanical Engineering Laboratory I F | K2
- MECH 394 Frontiers in Biomechanical Engineering W | 3.5
- MECH 397 Mechanical and Materials Engineering Laboratory II W | K2  
OR
- MECH 399 Mechanical Engineering Laboratory II W | K2

Minimum Total Credits: 40.0

### Fourth Year Common Core - 2019/2020

- Complementary Studies, List A, F or W | 6
- Complementary Studies, List A, B, C, or D, F or W | 3
- ME1 and ME2 Technical Electives (See Technical Elective List) F and W | 27.0
- ME3 Technical Electives (See Technical Elective List) F and W | 23.5

Important to Note: The above list is for a typical fourth year program and may vary depending on choices in previous years. Students must have a minimum total of 9 credits of Complementary Studies electives and a minimum of 27 credits of Technical Electives in the ME1 and ME2 options, and a minimum of 23.5 credits of Technical Electives in the ME3 option, as detailed below. This count includes any electives taken in a student's 2nd, 3rd and 4th years from the specific lists required for their option which are outlined in the Technical Elective description.

### General Sub-Plan (ME1) Core

- MECH 460 Team Project - Conceive and Design F | K4
- MECH 464 Communications and Project Management F | 1.5

Minimum Total Credits: 38

### Materials Sub-Plan (ME2) Core

- MECH 460 Team Project - Conceive and Design F | K4
- MECH 464 Communications and Project Management F | 1.5

Minimum Total Credits: 38

### Biomechanical Sub-Plan (ME3) Core

- MECH 460 Team Project - Conceive and Design F | K4
- MECH 464 Communications and Project Management F | 1.5
- MECH 462 Team Project - Implement and Operate W | K3.5

Minimum Total Credits: 38

All students must take a final year capstone design course in their program. For the ME1 and ME2 option students this course would normally be MECH 460 (4 credits, Fall) coupled with MECH 464 (1.5 credits, Fall). ME3 students will normally take MECH 460 (4 credits, Fall) coupled with MECH 464 (1.5 credits, Fall), in addition to MECH 462 (3.5 credits, Winter).

However, students in the ME1 and ME2 options may choose to take APSC 480 (9 credits, Fall and Winter), Multi-disciplinary Industry Engineering Design Project as a substitute for MECH 460 and MECH 464, and if the case will receive 3.5 credits of List 1 technical electives that will count towards their required minimum technical elective credit count.

ME3 students may choose to take APSC 480 (9 credits, FW) as a substitute for MECH 460, MECH 464, and MECH 462.

Note that APSC 480 has a prerequisite of APSC 381, normally taken in the winter term of third year.

Important Note: All students who want to take APSC 480 must make sure they **DROP** MECH 460, MECH 464, and MECH 462 from their preloaded courses on SOLUS, and **ADD** APSC 480. All students are limited to taking only **ONE** final year capstone project course, either MECH 460 or APSC 480.

## Complementary Studies

Refer to the Complementary Studies section of this calendar for details regarding the requirements for all Engineering plans. For the Mechanical Program, the Engineering Economics core course is APSC 221, and the Communications core courses are APSC 293 and MECH 464.

## Technical Electives

Students are required to complete technical electives dependent on their option, as listed below:

### ME1 Option

A minimum of 17.0 credits from any combination of courses on Lists 1, 2 or 3

A minimum of 3.5 additional credits from any combination of courses on Lists 1, 2, 3 or 4

A minimum of 6.5 additional credits from ANY Queen's undergraduate course

**For a minimum total requirement of technical electives of 27.0 credits**

### ME2 Option

A minimum of 10.0 credits from courses on List 2

A minimum of 7.0 additional credits from any combination of courses on Lists 1, 2 or 3

A minimum of 3.5 additional credits from any combination of courses on Lists 1, 2, 3 or 4

A minimum of 6.5 additional credits from ANY Queen's undergraduate course

**For a minimum total requirement of technical electives of 27.0 credits**

### **ME3 Option**

A minimum of 10.0 credits from courses on List 3

A minimum of 3.5 additional credits from any combination of courses on Lists 1, 2 or 3

A minimum of 3.5 additional credits from any combination of courses on Lists 1, 2, 3 or 4

A minimum of 6.5 additional credits from ANY Queen's undergraduate course

**For a minimum total requirement of technical electives of 23.5 credits**

**(Note that ME3 students are required to take MECH 462 as core, but it is an optional List 1 technical elective for ME1 and ME2 students. Students take the same total load in all three options.)**

**(As an example, 17.5 from List 1, 2 or 3; 3.0 from List 4; 6.5 from ANY Queen's undergraduate course(s) would also satisfy the ME1 requirement.)**

For all courses, students must meet the prerequisite requirements and no exclusion courses are allowed. Any exception to the requirements above must be approved by the Undergraduate Chair. It is the sole responsibility of the student to ensure that elective weights are sufficient to meet the total technical elective requirement.

All course availabilities and the term in which a course is held can change from one academic year to the next. This can occur due to curriculum changes, instructor availability or a change in departmental resources. Please refer to the individual course descriptions in the current calendar for further details.

## **Mechanical and Materials Engineering: Technical Elective Lists**

### **Mechanical and Materials Engineering, B.A.Sc. (Class of 2021)**

#### **Second Year Common Core- 2018/2019**

- MECH 217 Measurement in Mechatronics F | 4.25
- MECH 221 Solid Mechanics I F, O/L | 4
- MTHE 225 Ordinary Differential Equations F/W/S-OL | 3.5
- MECH 213 Manufacturing Methods F | 4.5
- MECH 230 Thermodynamics I F | 3.5
- MECH 270 Materials Science and Engineering F | 3.5
- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- ELEC 210 DELETED Introductory Electric Circuits and Machines W | 4.25
- MTHE 272 NOT OFFERED 2019-2020 - Application of Numerical Methods W | 3.5
- MECH 228 Kinematics and Dynamics W | K3.5
- MECH 241 Fluid Mechanics I W/S-OL | 3.5

**Minimum Total Credits: 43.25**

Note: Students should be aware that a transfer or a change in option choice may result in their program requirements taking more than the typical 4 years because of course availability and conflicts in their core timetable. The department cannot guarantee that courses will not conflict when a student changes options or transfers, especially after 2nd year.

MME students normally take APSC 200/293 in the winter term.

### Third Year Common Core- 2019/2020

- APSC 221 Economics and Business Practices in Engineering F/W/S | 3
  - MECH 321 Solid Mechanics II F | 3.5
  - MECH 328 Dynamics and Vibration F | 3.5
  - MECH 323 Machine Design W | 4.5
  - MECH 346 Heat Transfer W | 3.5
  - MECH 350 Automatic Control W | 3.5
  - MTHE 367 Engineering Data Analysis W | 3.5
- One Elective Course towards either Technical Elective or Complimentary Studies requirements F | 3.0  
(Typically 3 or more units)

### General Sub-Plan (ME1)

Note: MECH 396 and MECH 397 require MECH 370 and MECH 371 as co-requisites which would be additional courses in the third year for students in the ME1 or ME3 options.

- MECH 330 Applied Thermodynamics II F | 3.5
- MECH 396 Mechanical and Materials Engineering Laboratory I F | K2  
OR
- MECH 398 Mechanical Engineering Laboratory I F | K2
- MECH 341 Fluid Mechanics II W | 3.5
- MECH 397 Mechanical and Materials Engineering Laboratory II W | K2  
OR
- MECH 399 Mechanical Engineering Laboratory II W | K2

Minimum Total Credits: 40.0

### Materials Sub-Plan (ME2)

- MECH 370 Principles of Materials Processing F | 3.5
- MECH 396 Mechanical and Materials Engineering Laboratory I F | K2
- MECH 371 Fracture Mechanics and Dislocation Theory W | 3.5
- MECH 397 Mechanical and Materials Engineering Laboratory II W | K2

Minimum Total Credits: 40.0

### Biomechanical Sub-Plan (ME3)

Note: MECH 396 and MECH 397 require MECH 370 and MECH 371 as co-requisites which would be additional courses in the third year for students in the ME1 or ME3 options.

- MECH 393 Biomechanical Product Development F | 3.5
- MECH 396 Mechanical and Materials Engineering Laboratory I F | K2  
OR
- MECH 398 Mechanical Engineering Laboratory I F | K2
- MECH 394 Frontiers in Biomechanical Engineering W | 3.5
- MECH 397 Mechanical and Materials Engineering Laboratory II W | K2  
OR
- MECH 399 Mechanical Engineering Laboratory II W | K2

Minimum Total Credits: 40.0

#### Fourth Year Common Core- 2020/2021

- Complementary Studies, List A, F, or W | 6
- Complementary Studies, List A, B, C, or D, F or W | 3
- ME1 and ME2 Technical Electives (See Technical Elective List) F and W | 27.0
- ME3 Technical Electives (See Technical Elective List) F and W | 23.5

**Important to Note:** The above list is for a typical fourth year program and may vary depending on choices in previous years. Students must have a minimum total of 9 credits of Complementary Studies electives and a minimum of 27 credits of Technical Electives in the ME1 and ME2 options, and a minimum total of 23.5 credits of Technical Electives in the ME3 option, as detailed below. This count includes any electives taken in a student's 2nd, 3rd and 4th years from the specific lists required for their option which are outlined in the Technical Elective description.

#### General Sub-Plan (ME1) Core

- MECH 460 Team Project - Conceive and Design F | K4
- MECH 464 Communications and Project Management F | 1.5

Minimum Total Credits: 38

#### Materials Sub-Plan (ME2) Core

- MECH 460 Team Project - Conceive and Design F | K4
- MECH 464 Communications and Project Management F | 1.5

Minimum Total Credits: 38

#### Biomechanical Sub-Plan (ME3) Core

- MECH 460 Team Project - Conceive and Design F | K4
- MECH 464 Communications and Project Management F | 1.5
- MECH 462 Team Project - Implement and Operate W | K3.5

## Minimum Total Credits: 38

All students must take a final year capstone design course in their program. For the ME1 and ME2 option students this course would normally be MECH 460 (4 credits, Fall) coupled with MECH 464 (1.5 credits, Fall). ME3 students will normally take MECH 460 (4 credits, Fall) coupled with MECH 464 (1.5 credits, Fall) in addition to MECH 462 (3.5 credits, Winter).

However, students in the ME1 and ME2 options may choose to take APSC 480 (9 credits, Fall and Winter), Multi-disciplinary Industry Engineering Design Project as a substitute for MECH 460 and MECH 464, and will receive 3.5 credits of List 1 technical electives that will count towards their required minimum technical elective credit count.

ME3 students may choose to take APSC 480 (9 credits, FW) as a substitute for MECH 460, MECH 464, and MECH 462.

Note that APSC 480 has a prerequisite of APSC 381, normally taken in the winter term of third year.

Important Note: All students who want to take APSC 480 must make sure they **DROP** MECH 460, MECH 464, and MECH 462 from their pre-loaded courses on SOLUS, and **ADD** APSC 480. All students are limited to taking only **ONE** final year capstone project course, either MECH 460 or APSC 480.

## Complementary Studies

Refer to the Complementary Studies section of this calendar for details regarding the requirements for all Engineering plans. For the Mechanical Program, the Engineering Economics core course is APSC 221, and the Communications core courses are APSC 293 and MECH 464.

## Technical Electives

Students are required to complete technical electives dependent on their option, as listed below:

### **ME1 Option**

A minimum of 17.0 credits from any combination of courses on Lists 1, 2 or 3

A minimum of 3.5 additional credits from any combination of courses on Lists 1, 2, 3 or 4

A minimum of 6.5 additional credits from ANY Queen's undergraduate course

**For a minimum total requirement of technical electives of 27.0 credits**

### **ME2 Option**

A minimum of 10.0 credits from courses on List 2

A minimum of 7.0 additional credits from any combination of courses on Lists 1, 2 or 3

A minimum of 3.5 additional credits from any combination of courses on Lists 1, 2, 3 or 4

A minimum of 6.5 additional credits from ANY Queen's undergraduate course

**For a minimum total requirement of technical electives of 27.0 credits**



## ME3 Option

A minimum of 10.0 credits from courses on List 3

A minimum of 3.5 additional credits from any combination of courses on Lists 1, 2 or 3

A minimum of 3.5 additional credits from any combination of courses on Lists 1, 2, 3 or 4

A minimum of 6.5 additional credits from ANY Queen's undergraduate course

**For a minimum total requirement of technical electives of 23.5 credits**

**(Note that ME3 students are required to take MECH 462 as core, but it is an optional List 1 technical elective for ME1 and ME2 students. Students take the same total load in all three options.)**

**(As an example, 17.5 from List 1, 2 or 3; 3.0 from List 4; 6.5 from ANY Queen's undergraduate course(s) would also satisfy the ME1 requirement.)**

For all courses, students must meet the prerequisite requirements and no exclusion courses are allowed. Any exception to the requirements above must be approved by the Undergraduate Chair. It is the sole responsibility of the student to ensure that elective weights are sufficient to meet the total technical elective requirement.

All course availabilities and the term in which a course is held can change from one academic year to the next. This can occur due to curriculum changes, instructor availability or a change in departmental resources. Please refer to the individual course descriptions in the current calendar for further details.

## Mechanical and Materials Engineering: Technical Elective Lists

### Mechanical and Materials Engineering, B.A.Sc. (Class of 2022)

#### Second Year CORE 2019/2020

- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- MECH 202 Mathematical and Computational Tools for Mechanical Engineers I F | K3.5
- MECH 203 Mathematical and Computational Tools for Mechanical Engineers II W | K3.5
- MECH 210 Electronic Circuits and Motors for Mechatronics W | K4.5
- MECH 213 Manufacturing Methods F | 4.5
- MECH 217 Measurement in Mechatronics F | 4.25
- MECH 221 Solid Mechanics I F, O/L | 4
- MECH 228 Kinematics and Dynamics W | K3.5
- MECH 230 Thermodynamics I F | 3.5
- MECH 241 Fluid Mechanics I W/S-OL | 3.5
- MECH 270 Materials Science and Engineering F | 3.5
- MECH 273 Materials Science and Engineering Lab W | 1.0

Minimum Total Credits: 44.25

Note: Students should be aware that a transfer or a change in option choice may result in their program requirements taking more than the typical 4 years because of course availability and conflicts in their core timetable. The department cannot guarantee that courses will not conflict when a student changes options or transfers, especially after 2nd year.

MME students normally take APSC 200/293 in the winter term.

### Third Year CORE 2020/2021

- APSC 221 Economics and Business Practices in Engineering F/W/S | 3
- MECH 321 Solid Mechanics II F | 3.5
- MECH 323 Machine Design W | 4.5
- MECH 328 Dynamics and Vibration F | 3.5
- MECH 346 Heat Transfer W | 3.5
- MECH 350 Automatic Control W | 3.5
- MTHE 367 Engineering Data Analysis W | 3.5
- One Elective Course towards either Technical Elective or Complimentary Studies requirements F | 3.0 (Typically 3 or more units)

### General Sub-Plan (ME1)

Note: MECH 396 and MECH 397 require MECH 370 and MECH 371 as co-requisites which would be additional courses in the third year for students in the ME1 or ME3 options.

- MECH 330 Applied Thermodynamics II F | 3.5
- MECH 341 Fluid Mechanics II W | 3.5
- MECH 396 Mechanical and Materials Engineering Laboratory I F | K2  
OR
- MECH 398 Mechanical Engineering Laboratory I F | K2
- MECH 397 Mechanical and Materials Engineering Laboratory II W | K2  
OR
- MECH 399 Mechanical Engineering Laboratory II W | K2

Minimum Total Credits: 40.0

### Materials Sub-Plan (ME2)

- MECH 370 Principles of Materials Processing F | 3.5
- MECH 371 Fracture Mechanics and Dislocation Theory W | 3.5
- MECH 396 Mechanical and Materials Engineering Laboratory I F | K2
- MECH 397 Mechanical and Materials Engineering Laboratory II W | K2

Minimum Total Credits: 40.0

### Biomechanical Sub-Plan (ME3)

Note: MECH 396 and MECH 397 require MECH 370 and MECH 371 as co-requisites which would be additional courses in the third year for students in the ME1 or ME3 options.

- MECH 393 Biomechanical Product Development F | 3.5

- MECH 394 Frontiers in Biomechanical Engineering W | 3.5
- MECH 396 Mechanical and Materials Engineering Laboratory I F | K2  
OR
- MECH 398 Mechanical Engineering Laboratory I F | K2
- MECH 397 Mechanical and Materials Engineering Laboratory II W | K2  
OR
- MECH 399 Mechanical Engineering Laboratory II W | K2

Minimum Total Credits: 40.0

#### Fourth Year CORE 2021/2022

- Complementary Studies, List A, F, or W | 6
- Complementary Studies, List A, B, C, or D, F or W | 3
- ME1 and ME2 Technical Electives (See Technical Elective List) F and W | 27.0
- ME3 Technical Electives (See Technical Elective List) F and W | 23.5

**Important to Note:** The above list is for a typical fourth year program and may vary depending on choices in previous years. Students must have a minimum total of 9 credits of Complementary Studies electives and a minimum of 27 credits of Technical Electives in the ME1 and ME2 options, and a minimum total of 23.5 credits of Technical Electives in the ME3 option, as detailed below. This count includes any electives taken in a student's 2nd, 3rd and 4th years from the specific lists required for their option which are outlined in the Technical Elective description.

#### General Sub-Plan (ME1)

- MECH 460 Team Project - Conceive and Design F | K4
- MECH 464 Communications and Project Management F | 1.5

Minimum Total Credits: 38

#### Materials Sub-Plan (ME2)

- MECH 460 Team Project - Conceive and Design F | K4
- MECH 464 Communications and Project Management F | 1.5

Minimum Total Credits: 38

#### Biomechanical Sub-Plan (ME3)

- MECH 460 Team Project - Conceive and Design F | K4
- MECH 464 Communications and Project Management F | 1.5
- MECH 462 Team Project - Implement and Operate W | K3.5

Minimum Total Credits: 38

All students must take a final year capstone design course in their program. For the ME1 and ME2 option students this course would normally be MECH 460 (4 credits, Fall) coupled with MECH 464 (1.5 credits, Fall). ME3 students will normally take MECH 460 (4 credits, Fall) coupled with MECH 464 (1.5 credits, Fall) in addition to MECH 462 (3.5 credits, Winter).

However, students in the ME1 and ME2 options may choose to take APSC 480 (9 credits, Fall and Winter), Multi-disciplinary Industry Engineering Design Project as a substitute for MECH 460 and MECH 464, and will receive 3.5 credits of List 1 technical electives that will count towards their required minimum technical elective credit count.

ME3 students may choose to take APSC 480 (9 credits, FW) as a substitute for MECH 460, MECH 464, and MECH 462.

Note that APSC 480 has a prerequisite of APSC 381, normally taken in the winter term of third year.

Important Note: All students who want to take APSC 480 must make sure they DROP MMECH 460, MECH 464, and MECH 462 from their pre-loaded courses on SOLUS, and ADD APSC 480. All students are limited to taking only ONE final year capstone project course, either MECH 460 or APSC 480.

## Complementary Studies

Refer to the Complementary Studies section of this calendar for details regarding the requirements for all Engineering plans. For the Mechanical Program, the Engineering Economics core course is APSC 221, and the Communications core courses are APSC 293 and MECH 464 (or APSC 480).

## Technical Electives

Students are required to complete technical electives dependent on their option, as listed below:

### ME1 Option

A minimum of 17.0 credits from any combination of courses on Lists 1, 2 or 3

A minimum of 3.5 additional credits from any combination of courses on Lists 1, 2, 3 or 4

A minimum of 6.5 additional credits from ANY Queen's undergraduate course

**For a minimum total requirement of technical electives of 27.0 credits**

### ME2 Option

A minimum of 10.5 credits from courses on List 2

A minimum of 7.0 additional credits from any combination of courses on Lists 1, 2 or 3

A minimum of 3 additional credits from any combination of courses on Lists 1, 2, 3 or 4

A minimum of 6.5 additional credits from ANY Queen's undergraduate course

**For a minimum total requirement of technical electives of 27.0 credits**

### ME3 Option

A minimum of 10.0 credits from courses on List 3

A minimum of 3.5 additional credits from any combination of courses on Lists 1, 2 or 3

A minimum of 3.5 additional credits from any combination of courses on Lists 1, 2, 3 or 4

A minimum of 6.5 additional credits from ANY Queen's undergraduate course

**For a minimum total requirement of technical electives of 23.5 credits**

**(Note that ME3 students are required to take MECH 462 as core, but it is an optional List 1 technical elective for ME1 and ME2 students. Students take the same total load in all three options.)**

**(As an example, 17.5 from List 1, 2 or 3; 3.0 from List 4; 6.5 from ANY Queen's undergraduate course(s) would also satisfy the ME1 requirement.)**

For all courses, students must meet the prerequisite requirements and no exclusion courses are allowed. Any exception to the requirements above must be approved by the Undergraduate Chair. It is the sole responsibility of the student to ensure that elective weights are sufficient to meet the total technical elective requirement.

All course availabilities and the term in which a course is held can change from one academic year to the next. This can occur due to curriculum changes, instructor availability or a change in departmental resources. Please refer to the individual course descriptions in the current calendar for further details.

Mechanical and Materials Engineering: Technical Elective Lists

### **Mechanical and Materials Engineering: Technical Electives**

These lists establish which courses qualify to meet the program elective requirements for each of the academic plans.

## List 1: General Mechanical Engineering Electives

These courses provide experiences that are central to the development of General Mechanical Engineering attributes. Lists 1A and 1B are included in List 1 for meeting technical elective requirements.

- APSC 381 Advanced Design and Skills for Innovation W | K3.5 (Must typically be taken in 3rd year if students choose to take APSC 480 as their capstone project, instead of MECH 460, MECH 464 **AND** MECH 462 if in the ME3 option.)
- APSC 400 Technology, Engineering & Management (TEAM) FW\* | 7 K7
- CHEE 400 DELETED Technology, Engineering & Management (TEAM) FW | K7
- CHEE 490 Polymer Formulations and Processing Technology W | 3.5
- ELEC 280 Fundamentals of Electromagnetics W | 3.75
- ELEC 333 Electric Machines F | 4.5
- MECH 330 Applied Thermodynamics II F | 3.5 (Option core to ME1, and a List 1 Tech for ME2 and ME3)
- MECH 341 Fluid Mechanics II W | 3.5 (Option core to ME1, and a List 1 Tech for ME2 and ME3)
- MECH 361 Project Based Engineering: Conceive, Design, Implement and Operate W | K3.5
- MECH 370 Principles of Materials Processing F | 3.5 (Option core to ME2, and List 1 to ME1 and ME3)
- MECH 371 Fracture Mechanics and Dislocation Theory W | 3.5 (Option core to ME2, and List 1 to ME1 and ME3)

- MECH 393 Biomechanical Product Development F | 3.5 (Option core to ME3, and a List 1 Tech for ME1 and ME2)
- MECH 394 Frontiers in Biomechanical Engineering W | 3.5 (Option core to ME3, and a List 1 Tech for ME1 and ME2)
- MECH 420 Vibrations W | 3.5
- MECH 423 Introduction to Microsystems W | 3.5
- MECH 424 Sustainable Product Design F | 3.5
- MECH 430 NOT OFFERED 2019-2020 Thermal Systems Design W | 4
- MECH 435 Internal Combustion Engines W | 3.5
- MECH 437 Fuel Cell Technology F | 3.5
- MECH 439 Turbomachinery F | 3.5
- MECH 441 NOT OFFERED 2019/2020 - Fluid Mechanics III W | 3.5
- MECH 444 Computational Fluid Dynamics F | 3.5
- MECH 448 Compressible Fluid Flow F | 3.5
- MECH 452 Mechatronics Engineering F | 5
- MECH 455 NOT OFFERED 2019-2020 - Computer Integrated Manufacturing F | 3.5
- MECH 456 NOT OFFERED 2019-2020 - Introduction to Robotics F | 3.5
- MECH 461 Research Project W | K4
- MECH 462 Team Project - Implement and Operate W | K3.5 (Option core to ME3, and a List 1 Tech for ME1 and ME2)
- MECH 465 Computer-Aided Design F | 3.5
- MECH 480 NOT OFFERED 2019-2020 - Airplane Aerodynamics and Performance W | 3.5
- MECH 481 Wind Energy F | 3.5
- MECH 482 Noise Control W | 3.5

### **List 1A: Engineering Science**

These List 1 courses include substantial Engineering Science content and are staffed by Mechanical and Materials Engineering with licensed Professional Engineers, or EITs, as instructors to meet the requirements of CEAB Appendix 3.

- MECH 492 Biological Fluid Dynamics F | 3.5

### **List 1B: Engineering Design**

These List 1 courses include substantial Engineering Design content and are staffed by Mechanical and Materials Engineering with licensed Professional Engineers as instructors to meet the requirements of CEAB Appendix 3.

- MECH 495 Ergonomics and Design W | 3.5

### **List 2: Materials Engineering Electives**

- MECH 461 Research Project W | K4
- MECH 470 Deformation Processing W | 3.5
- MECH 476 Engineering of Polymers and Composite Materials W | 3.5
- MECH 478 Biomaterials F | 3.5
- MECH 479 Nano-Structured Materials F | 3.5
- MECH 483 Nuclear Materials F | 3.5
- MECH 484 NOT OFFERED 2019-2020 - Introduction to Ceramics F | 3.5

### List 3: Biomechanical Engineering Electives

- MECH 461 Research Project W | K4
- CHEE 380 Biochemical Engineering F | 3.5
- CHEE 440 Pharmaceutical Technology W | 3.5
- CHEE 450 DELETED - Engineering Biology W | 3.5
- CHEE 484 NOT OFFERED 2019-2020 Bioremediation W | 3.5
- ELEC 408 Biomedical Signal and Image Processing W | 3
- MECH 465 Computer-Aided Design F | 3.5
- MECH 478 Biomaterials F | 3.5
- MECH 492 Biological Fluid Dynamics F | 3.5
- MECH 494 Kinematics of Human Motion F | 3.5
- MECH 495 Ergonomics and Design W | 3.5
- MECH 496 Musculoskeletal Biomechanics F | 3.5

### List 4: Multi-Disciplinary Engineering Electives

- ANAT 100 Anatomy of the Human Body F,W,S | 3.0
- APSC 250 Biology Through an Engineering Lens S/OL | K3.5
- CHEE 340 Biomedical Engineering W | 3.5
- CHEE 342 Environmental Biotechnology F | 3.5
- CHEE 370 Deleted - Waste Treatment Processes W | 3.5
- CHEE 371 Mitigation of Industrial Pollution W | 3.5
- CHEE 412 Transport Phenomena W | 3.5
- CHEE 363 Electrochemical Engineering\* W | 3.5
- CIVL 371 Groundwater Engineering F | 3.75
- CIVL 372 Water and Wastewater Engineering W | 4
- CIVL 471 Subsurface Contamination W | 4
- CIVL 473 Water Resources System W |
- ELEC 271 Digital Systems F | 4
- ELEC 274 Computer Architecture W | 4
- ELEC 371 Microprocessor Interfacing and Embedded Systems F | 4
- MTHE 212 Linear Algebra W | 3.5
- MTHE 337 Introduction to Operations Research Models W | 3
- MTHE 338 Fourier Methods for Boundary Value Problems F | 3.5
- MTHE 434 NOT OFFERED 2019-2020 - Optimization Theory with Applications to Machine Learning F | 3.5
- MTHE 472 Control of Stochastic Systems W | 3
- MINE 459 Risk and Reliability Analysis for Industrial Asset Management, Health & Safety F | 4
- ENPH 491 NOT OFFERED 2019-2020 Physics of Nuclear Reactors F | 3.5

### Areas of Concentration in Mechanical

Although there is no formal streaming of electives in the Mechanical Engineering Curriculum, the following groupings are provided in order to give students some guidance in areas where they may wish to concentrate their studies.

#### Aerospace Engineering

- MECH 371 Fracture Mechanics and Dislocation Theory W | 3.5 (Core for ME2 option)
- MECH 437 Fuel Cell Technology F | 3.5
- MECH 439 Turbomachinery F | 3.5
- MECH 441 NOT OFFERED 2019/2020 - Fluid Mechanics III W | 3.5
- MECH 444 Computational Fluid Dynamics F | 3.5
- MECH 448 Compressible Fluid Flow F | 3.5
- MECH 465 Computer-Aided Design F | 3.5
- MECH 480 NOT OFFERED 2019-2020 - Airplane Aerodynamics and Performance W | 3.5
- MECH 481 Wind Energy F | 3.5

## Biomechanical Engineering

- CHEE 340 Biomedical Engineering W | 3.5
- CHEE 450 DELETED - Engineering Biology W | 3.5
- MECH 370 Principles of Materials Processing F | 3.5 (Core for ME2 option)
- MECH 371 Fracture Mechanics and Dislocation Theory W | 3.5 (Core for ME2 option)
- MECH 393 Biomechanical Product Development F | 3.5 (Core for ME3 option)
- MECH 394 Frontiers in Biomechanical Engineering W | 3.5 (Core for ME3 option)
- MECH 465 Computer-Aided Design F | 3.5
- MECH 478 Biomaterials F | 3.5
- MECH 492 Biological Fluid Dynamics F | 3.5
- MECH 494 Kinematics of Human Motion F | 3.5
- MECH 495 Ergonomics and Design W | 3.5
- MECH 496 Musculoskeletal Biomechanics F | 3.5

## Manufacturing Engineering

- APSC 381 Advanced Design and Skills for Innovation W | K3.5
- CHEE 400 DELETED Technology, Engineering & Management (TEAM) FW | K7
- MECH 370 Principles of Materials Processing F | 3.5 (Core for ME2 option)
- MECH 424 Sustainable Product Design F | 3.5
- MECH 455 NOT OFFERED 2019-2020 - Computer Integrated Manufacturing F | 3.5
- MECH 462 Team Project - Implement and Operate W | K3.5 (Core for ME3 option)
- MECH 465 Computer-Aided Design F | 3.5
- MECH 476 Engineering of Polymers and Composite Materials W | 3.5
- MECH 482 Noise Control W | 3.5

## Mechatronics Engineering

- ELEC 271 Digital Systems F | 4
- ELEC 274 Computer Architecture W | 4
- ELEC 371 Microprocessor Interfacing and Embedded Systems F | 4
- MECH 420 Vibrations W | 3.5
- MECH 423 Introduction to Microsystems W | 3.5
- MECH 452 Mechatronics Engineering F | 5
- MECH 455 NOT OFFERED 2019-2020 - Computer Integrated Manufacturing F | 3.5
- MECH 456 NOT OFFERED 2019-2020 - Introduction to Robotics F | 3.5



- MECH 482 Noise Control W | 3.5

## Energy and Fluid Systems

- MECH 430 NOT OFFERED 2019-2020 Thermal Systems Design W | 4
- MECH 435 Internal Combustion Engines W | 3.5
- MECH 437 Fuel Cell Technology F | 3.5
- MECH 439 Turbomachinery F | 3.5
- MECH 441 NOT OFFERED 2019/2020 - Fluid Mechanics III W | 3.5
- MECH 444 Computational Fluid Dynamics F | 3.5
- MECH 448 Compressible Fluid Flow F | 3.5
- MECH 480 NOT OFFERED 2019-2020 - Airplane Aerodynamics and Performance W | 3.5
- MECH 481 Wind Energy F | 3.5
- MECH 492 Biological Fluid Dynamics F | 3.5

## Materials Engineering

- MECH 370 Principles of Materials Processing F | 3.5 (Core to ME2 option)
- MECH 371 Fracture Mechanics and Dislocation Theory W | 3.5 (Core to ME2 option)
- MECH 470 Deformation Processing W | 3.5
- MECH 476 Engineering of Polymers and Composite Materials W | 3.5
- MECH 478 Biomaterials F | 3.5
- MECH 479 Nano-Structured Materials F | 3.5
- MECH 483 Nuclear Materials F | 3.5
- MECH 484 NOT OFFERED 2019-2020 - Introduction to Ceramics F | 3.5

## Mining Engineering

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The mineral industry deals with the excavation and processing of ore to obtain the mineral products required by contemporary society. To meet industrial requirements, the curriculum of Mining Engineering provides three closely associated options: Mining Engineering, Mineral Processing and Environmental Engineering and Mine-Mechanical Engineering. The Mining Engineering Option, in addition to the fundamentals of mining, includes elements of earthworks and excavation for both surface and underground. In the Mineral Processing and Environmental Engineering option, the subjects addressed include the design, operation and control of ore treatment plants and the environmental control systems required by government regulations. The Mine-Mechanical option produces mining engineers who understand the design, modification, automation, use and maintenance of heavy and specialized equipment in the mining industry.

Options available:

- Mining Option

- Mineral Processing Option
- Mechanical Option

### **Mining Engineering, B.A.Sc. (Class of 2020)**

#### Second Year Common Core - 2017/2018

- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- CIVL 230 Solid Mechanics I F | 4.25
- MINE 201 Introduction to Mining and Mineral Processing F | 4
- MINE 202 Computer Applications and Instrumentation in Mining F | 1.5
- APSC 221 Economics and Business Practices in Engineering F/W/S | 3
- ELEC 210 DELETED Introductory Electric Circuits and Machines W | 4.25
- MINE 244 Underground Mining (changed to MINE 344) W | 3
- MTHE 272 NOT OFFERED 2019-2020 - Application of Numerical Methods W | 3.5
- MTHE 225 Ordinary Differential Equations F/W/S-OL | 3.5

Subtotal Credits: 32

#### Mining Option N1

- MECH 230 Thermodynamics I F | 3.5
- MINE 267 Applied Chemistry for Mining W | 3.5
- MINE 268 Analytical Methods in Mining W | 1
- MTHE 367 Engineering Data Analysis W | 3.5

Subtotal Credits: 11.5

Minimum Total Credits: 43.5

#### Minerals Processing Environmental Option N2

- CHEE 209 Analysis of Process Data F | 3.5
- CHEE 210 Thermodynamics of Energy Conversion Systems W | 3.5
- MINE 267 Applied Chemistry for Mining W | 3.5
- MINE 268 Analytical Methods in Mining W | 1

Subtotal Credits: 11.5

Minimum Total Credits: 43.5

#### Mine-Mechanical Option N3

- MECH 230 Thermodynamics I F | 3.5
- MECH 228 Kinematics and Dynamics W | K3.5

- MTHE 367 Engineering Data Analysis W | 3.5

Subtotal Credits: 10.5

Minimum Total Credits: 42.5

### Third Year Common Core - 2018/2019

- MINE 321 Drilling and Blasting F | 4.5
- MINE 331 Methods of Mineral Separation F | 4.5
- MINE 341 Open Pit Mining F | 4.5
- GEOE 262 Geological Aspects of Mineral Deposits W | 3.75
- MINE 225 Applied Rock Mechanics (Changing from MINE 325) W | 4.5
- MINE 324 Hydraulics for Mining Applications W | 3.5
- MINE 326 Operations Research W | 4.5

Subtotal Credits: 29.75

### Mining Option N1

- MINE 339 Mine Ventilation F | 4.5
- Complementary Studies, List A F | 3
- Elective F | 3
- MINE 330 Mineral Industry Economics F | 3.5
- Elective W | 3

Subtotal Credits: 17

Minimum Total Credits: 46.75

### Minerals Processing Environmental Option N2

- CHEE 321 Chemical Reaction Engineering F | 3.5
- Complementary Studies, List A F | 3
- Elective F | 3
- CHEE 319 Process Dynamics and Control W | 3.5
- MINE 330 Mineral Industry Economics F | 3.5

Subtotal Credits: 16.5

Minimum Total Credits: 46.25

### Mine-Mechanical Option N3

- MECH 270 Materials Science and Engineering F | 3.5
- MECH 328 Dynamics and Vibration F | 3.5

- Complementary Studies, List A F | 3
- MECH 323 Machine Design W | 4.5
- MECH 350 Automatic Control W | 3.5

Subtotal Credits: 18.25

Minimum Total Credits: 48

#### Fourth Year Common Core - 2019/2020

- MINE 422 Mining and Sustainability F | 4
- MINE 459 Risk and Reliability Analysis for Industrial Asset Management, Health & Safety F | 4

Subtotal Credits: 8

#### Mining Option N1

- MINE 467 Geostatistics and Orebody Modelling F | 4.5
- MINE 469 Stability Analysis in Mine Design F | 4
- Elective F | 3
- MINE 445 Open Pit Mine Design W | 5.5
- MINE 448 Underground Design W | 5.5
- Complementary Studies, List A W | 3  
Elective W | 3  
Elective W | 3

Subtotal Credits: 31.5

Minimum Total Credits: 39.5

#### Minerals Processing Environmental Option N2

- MINE 451 Chemical Extraction of Metals F | 3
- MINE 455 Design, Analysis and Operation of Mineral Processes F | 4.5
- Elective F | 3
- MINE 458 Process Investigations W | 4
- Complementary Studies, List A W | 3  
Elective W | 3  
Elective W | 3  
Elective W | 3

Subtotal Credits: 26.5

Minimum Total Credits: 34.5

#### Mine-Mechanical Option N3

- MINE 330 Mineral Industry Economics F | 3.5
- MINE 339 Mine Ventilation F | 4.5
- Complementary Studies, List A F | 3
- Elective F | 3
- MINE 471 Mine-Mechanical Design Project W | 5.5
- Elective W | 3
- Elective W | 3
- Elective W | 3
- Elective W | 3

Subtotal Credits: 31.5

Minimum Total Credits: 39.5

### Elective requirements

- Students in all options (N1-Mine-Mine, N2-Mineral Processing Environmental, N3-Mine-Mechanical) must take a minimum of five courses from the approved Elective lists.

Mining Engineering: Electives

### Complementary Studies

Refer to the Complementary Studies section of this calendar for details regarding the requirements for all Engineering programs. For the Mining Program, the Engineering Economics courses are APSC 221 and MINE 330. The Communications course is APSC 293 . Included in the core program is an additional 2.0 credits of Linkage in MINE 459 .

### **Mining Engineering, B.A.Sc. (Class of 2021)**

#### Second Year Common Core - 2018/2019

- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 293 Engineering Communications I F/W | K1
- CIVL 230 Solid Mechanics I F | 4.25
- MINE 201 Introduction to Mining and Mineral Processing F | 4
- MINE 202 Computer Applications and Instrumentation in Mining F | 1.5
- MTHE 225 Ordinary Differential Equations F/W/S-OL | 3.5
- APSC 221 Economics and Business Practices in Engineering F/W/S | 3
- ELEC 210 DELETED Introductory Electric Circuits and Machines W | 4.25
- MINE 225 Applied Rock Mechanics (Changing from MINE 325) W | 4.5
- MTHE 272 NOT OFFERED 2019-2020 - Application of Numerical Methods W | 3.5

Subtotal Credits: 33.5

### Mining Option N1

- MECH 230 Thermodynamics I F | 3.5
- MINE 267 Applied Chemistry for Mining W | 3.5
- MINE 268 Analytical Methods in Mining W | 1
- MTHE 367 Engineering Data Analysis W | 3.5

Subtotal Credits: 11.5

Minimum Total Credits: 45

### Minerals Processing Environmental Option N2

- CHEE 209 Analysis of Process Data F | 3.5
- CHEE 210 Thermodynamics of Energy Conversion Systems W | 3.5
- MINE 267 Applied Chemistry for Mining W | 3.5
- MINE 268 Analytical Methods in Mining W | 1

Subtotal Credits: 11.5

Minimum Total Credits: 45

### Mine-Mechanical Option N3

- MECH 230 Thermodynamics I F | 3.5
- MECH 228 Kinematics and Dynamics W | K3.5
- MTHE 367 Engineering Data Analysis W | 3.5

Subtotal Credits: 10.5

Minimum Total Credits: 44

### Third Year Common Core - 2019/2020

- MINE 321 Drilling and Blasting F | 4.5
- MINE 330 Mineral Industry Economics F | 3.5
- MINE 331 Methods of Mineral Separation F | 4.5
- MINE 341 Open Pit Mining F | 4.5
- GEOE 262 Geological Aspects of Mineral Deposits W | 3.75
- MINE 324 Hydraulics for Mining Applications W | 3.5
- MINE 326 Operations Research W | 4.5
- MINE 344 Underground Mining W | 3

Subtotal Credits: 31.75

### Mining Option N1

- Elective F | 3

- Complementary Studies, List A W | 3
- MINE 339 Mine Ventilation F | 4.5
- Elective W | 3

Subtotal Credits: 13.5

Minimum Total Credits: 45.25

### Minerals Processing Environmental Option N2

- CHEE 321 Chemical Reaction Engineering F | 3.5
- Elective W | 3
- CHEE 319 Process Dynamics and Control W | 3.5

Subtotal Credits: 13

Minimum Total Credits: 44.75

### Mine-Mechanical Option N3

- MECH 270 Materials Science and Engineering F | 3.5
- MECH 328 Dynamics and Vibration F | 3.5
- MECH 323 Machine Design W | 4.5
- MECH 350 Automatic Control W | 3.5

Subtotal Credits: 15

Minimum Total Credits: 46.75

### Fourth Year Common Core - 2020/2021

- MINE 422 Mining and Sustainability F | 4
- MINE 459 Risk and Reliability Analysis for Industrial Asset Management, Health & Safety F | 4

Subtotal Credits: 8

### Mining Option N1

- MINE 467 Geostatistics and Orebody Modelling F | 4.5
- MINE 469 Stability Analysis in Mine Design F | 4
- Elective F | 3
- MINE 445 Open Pit Mine Design W | 5.5
- MINE 448 Underground Design W | 5.5
- Complementary Studies, List A W | 3
- Elective W | 3
- Elective W | 3

Subtotal Credits: 31.5

Minimum Total Credits: 39.5

### Minerals Processing Environmental Option N2

- MINE 451 Chemical Extraction of Metals F | 3
- MINE 455 Design, Analysis and Operation of Mineral Processes F | 4.5
- Elective F | 3
- MINE 458 Process Investigations W | 4
- Complementary Studies, List A W | 3
- Elective W | 3
- Elective W | 3
- Elective W | 3

Subtotal Credits: 26.5

Minimum Total Credits: 34.5

### Mine-Mechanical Option N3

- MINE 339 Mine Ventilation F | 4.5
- Complementary Studies, List A F | 3
- Elective F | 3
- Elective F | 3
- MINE 471 Mine-Mechanical Design Project W | 5.5
- Complementary Studies, List A W | 3
- Elective W | 3
- Elective W | 3
- Elective W | 3

Subtotal Credits: 28

Minimum Total Credits: 36

### Elective requirements

Students in all options (N1-Mine-Mine, N2-Mineral Processing Environmental, N3-Mine-Mechanical) must take a minimum of five courses from the approved Elective lists.

Mining Engineering: Electives

### Complementary Studies

Refer to the Complementary Studies section of this calendar for details regarding the requirements for all Engineering programs. For the Mining Program, the Engineering Economics courses are APSC 221 and MINE 330. The Communications course is APSC 293 . Included in the core program is an additional 2.0 credits of Linkage in MINE 459 .



## **Mining Engineering, B.A.Sc. (Class of 2022)**

change to the Electives list and the statement for Elective requirements and Complementary studies

### **Second Year Common Core - 2019/2020**

- APSC 200 Engineering Design and Practice II F/W | K4
- APSC 221 Economics and Business Practices in Engineering F/W/S | 3
- APSC 293 Engineering Communications I F/W | K1
- CIVL 222 Numerical Methods for Civil Engineers W | 5
- CIVL 230 Solid Mechanics I F | 4.25
- MECH 210 Electronic Circuits and Motors for Mechatronics W | K4.5
- MINE 201 Introduction to Mining and Mineral Processing F | 4
- MINE 202 Computer Applications and Instrumentation in Mining F | 1.5
- MINE 225 Applied Rock Mechanics (Changing from MINE 325) W | 4.5
- MTHE 225 Ordinary Differential Equations F/W/S-OL | 3.5

Subtotal Credits: 35.25

### **Mining Option N1**

- CHEE 209 Analysis of Process Data F | 3.5  
Complementary Studies, List A F | 3
- CHEE 210 Thermodynamics of Energy Conversion Systems W | 3.5
- MINE 267 Applied Chemistry for Mining W | 3.5
- MINE 268 Analytical Methods in Mining W | 1

Subtotal Credit: 14.5

Minimum Total Credits: 49.75

### **Minerals Processing Environmental Option N2**

- CHEE 209 Analysis of Process Data F | 3.5  
Complementary Studies, List A F | 3
- CHEE 210 Thermodynamics of Energy Conversion Systems W | 3.5
- MINE 267 Applied Chemistry for Mining W | 3.5
- MINE 268 Analytical Methods in Mining W | 1

Subtotal Credits: 14.5

Minimum Total Credits: 49.75

### **Mine-Mechanical Option N3**

- CHEE 209 Analysis of Process Data F | 3.5  
Complementary Studies, List A F | 3

- CHEE 210 Thermodynamics of Energy Conversion Systems W | 3.5
- MECH 228 Kinematics and Dynamics W | K3.5

Subtotal Credits: 13.5

Minimum Total Credits: 48.75

### Third Year Common Core - 2020/2021

- GEOE 262 Geological Aspects of Mineral Deposits W | 3.75
- MINE 321 Drilling and Blasting F | 4.5
- MINE 324 Hydraulics for Mining Applications W | 3.5
- MINE 326 Operations Research W | 4.5
- MINE 331 Methods of Mineral Separation F | 4.5
- MINE 341 Open Pit Mining F | 4.5
- MINE 344 Underground Mining W | 3

Subtotal Credits: 28.25

### Mining Option N1

- MINE 330 Mineral Industry Economics F | 3.5
- Elective F | 3
- MINE 339 Mine Ventilation F | 4.5
- Elective W | 3

Subtotal Credits: 14

Minimum Total Credits: 42.25

### Minerals Processing Environmental Option N2

- Elective F | 3
- CHEE 319 Process Dynamics and Control W | 3.5
- CHEE 321 Chemical Reaction Engineering F | 3.5
- MINE 330 Mineral Industry Economics F | 3.5

Subtotal Credits: 13.5

Minimum Total Credits: 41.75

### Mine-Mechanical Option N3

- MECH 270 Materials Science and Engineering F | 3.5
- MECH 323 Machine Design W | 4.5
- MECH 328 Dynamics and Vibration F | 3.5

- MECH 350 Automatic Control W | 3.5
- MINE 330 Mineral Industry Economics F | 3.5

Subtotal Credit: 18.5

Minimum Total Credits: 46.75

#### Fourth Year Common Core - 2021/2022

- MINE 422 Mining and Sustainability F | 4
- MINE 459 Risk and Reliability Analysis for Industrial Asset Management, Health & Safety F | 4

Subtotal Credit: 8

#### Mining Option N1

- MINE 445 Open Pit Mine Design W | 5.5
- MINE 448 Underground Design W | 5.5
- MINE 467 Geostatistics and Orebody Modelling F | 4.5
- MINE 469 Stability Analysis in Mine Design F | 4
- Elective F | 3
- Complementary Studies, List A W | 3
- Elective W | 3
- Elective W | 3

Subtotal Credits: 31.5

Minimum Total Credits: 39.5

#### Minerals Processing Environmental Option N2

- MINE 451 Chemical Extraction of Metals F | 3
- MINE 455 Design, Analysis and Operation of Mineral Processes F | 4.5
- MINE 458 Process Investigations W | 4
- Elective F | 3
- Complementary Studies, List A W | 3
- Elective W | 3
- Elective W | 3
- Elective W | 3

Subtotal Credits: 26.5

Minimum Total Credits: 34.5

#### Mine-Mechanical Option N3

- MINE 339 Mine Ventilation F | 4.5
- MINE 471 Mine-Mechanical Design Project W | 5.5
- Complementary Studies, List A F | 3
- Elective F | 3
- Elective W | 3
- Elective W | 3
- Elective W | 3
- Elective W | 3

Subtotal Credits: 28

Minimum Total Credits: 36

### Elective Requirements

Students in all options (N1-Mine-Mine, N2-Mineral Processing Environmental, N3-Mine-Mechanical) must take a minimum of five courses from the approved Elective lists.

Mining Engineering: Electives

### Complementary Studies

Refer to the [Complementary Studies](#) section of this calendar for details regarding the requirements for all Engineering programs. For the Mining Program, the Engineering Economics courses are [APSC 221](#) and [MINE 330](#). The Communications courses are [APSC 293](#). Included in the core program is an additional 2.0 credits of Linkage in [MINE 459](#)

### Mining Engineering: Electives

### Elective Requirements

Students in all three options (N1, N2, N3) must take a minimum of 15 credits of Elective courses from the approved Elective list.

Of these 15 credits, at least 6 credits must be from the relevant Mining Electives List A (-N1, -N2, or -N3). The remaining credits can be from Mining Electives List B, or also from the relevant Mining Electives List A (-N1, -N2, or -N3).

Elective List

- Some of the courses listed in this table also appear on Complimentary Studies List "A". Please note that a course can only count as either an Elective or a Complementary Studies List A (not as both).
- Please note that it is the student's responsibility to check SOLUS to determine if a courses is being offered during a particular year and if it is, in which term it is being held. Course availability and the term in which it is held can change on a yearly basis.

### Mining Electives List A - N1

- APSC 250 Biology Through an Engineering Lens S/OL | K3.5
- CHEE 319 Process Dynamics and Control W | 3.5
- MECH 350 Automatic Control W | 3.5
- MNTC 313 Introduction to Programming O/L | 3
- MNTC 415 Metal Extraction Processes O/L | 3
- MNTC 419 Mine Supervision and Project Management O/L | 3
- MNTC 423 Geomatics O/L | 3
- LAW 204 Corporate Law
- MINE 451 Chemical Extraction of Metals F | 3

### Mining Electives List A - N2

- APSC 250 Biology Through an Engineering Lens S/OL | K3.5
- MNTC 311 Ore Body Modelling and Resource Estimation O/L | 3
- MNTC 313 Introduction to Programming O/L | 3
- MNTC 316 Ventilation and Hydraulics O/L | 3
- MNTC 413 Surface Mine Planning O/L | 3
- MNTC 414 Underground Mine Planning O/L | 3
- MNTC 419 Mine Supervision and Project Management O/L | 3
- MNTC 423 Geomatics O/L | 3
- LAW 204 Corporate Law

### Mining Electives List A - N3

- APSC 250 Biology Through an Engineering Lens S/OL | K3.5
- MINE 451 Chemical Extraction of Metals F | 3
- MNTC 313 Introduction to Programming O/L | 3
- MNTC 311 Ore Body Modelling and Resource Estimation O/L | 3
- MNTC 415 Metal Extraction Processes O/L | 3
- MNTC 419 Mine Supervision and Project Management O/L | 3
- MNTC 423 Geomatics O/L | 3
- LAW 204 Corporate Law

### Mining Electives List B

- MINE 300 series Any 3<sup>rd</sup>-year non-core mining course offered by the mining department
- MINE 400 series Any 4<sup>th</sup>-year non-core mining course offered by the mining department
- MINE 800 series Any graduate mining course offered by the mining department and with approval of the School of Graduate Studies
- Languages Any language course from List "A" and List "C" selections. Note: Student's language skills will be evaluated prior to the approval of any language course.
- APSC 250 Biology Through an Engineering Lens S/OL | K3.5
- APSC 400 Technology, Engineering & Management (TEAM) FW\* | 7 K7
- APSC 480 Multi-disciplinary Industry Engineering Design Project FW | K9
- CHEE 302 Technical Entrepreneurship W/OL, F/OL, S/OL | K3.5
- CHEE 310 Deleted-Engineering Innovation and Entrepreneurship F | 3.5
- CHEE 323 Industrial Catalysis w | 3.5

- CHEE 330 Heat and Mass Transfer F | 3.5
- CHEE 342 Environmental Biotechnology F | 3.5
- CHEE 371 Mitigation of Industrial Pollution W | 3.5
- CHEE 380 Biochemical Engineering F | 3.5
- CHEE 412 Transport Phenomena W | 3.5
- CHEE 414 Foundations of the Oil and Gas Industry w | 3.5
- CHEE 418 Strategies for Process Investigations F | 3.5
- CHEE 434 Process Control II W | 3.5
- CHEE 460 Applied Surface and Colloid Science F | 3.5
- CIVL 215 Materials for Civil Engineers W | 4.5
- CIVL 340 Geotechnical Engineering I F | 3.75
- CIVL 341 Geotechnical Engineering II W | 4
- CIVL 371 Groundwater Engineering F | 3.75
- CIVL 471 Subsurface Contamination W | 4
- COMM 200 Introduction to Business 3
- COMM 211 Introduction to Financial Accounting 3
- COMM 212 Introduction to Management Accounting 3
- COMM 221 Introduction to Finance 3
- COMM 231 Introduction to Marketing 3
- COMM 251 Organizational Behaviour 3
- COMM 305 Introduction to Entrepreneurship 3
- COMM 310 Environmental Accounting 3
- COMM 311 Financial Accounting Practices, Principles and Concepts 3
- COMM 322 Financial Management: Strategy 3
- COMM 323 Corporate Financial Planning 3
- COMM 324 Investment and Portfolio Management 3
- COMM 325 Financial Modelling 3
- COMM 328 International Finance 3
- COMM 351 Leadership 3
- COMM 353 Managing Across Cultures 3
- COMM 357 Interpersonal Skills for Managers 3
- COMM 359 Power and Organizational Politics 3
- COMM 375 International Business 3
- COMM 381 Business Law I 3
- COMM 382 Business Law II 3
- COMM 408 Sustainability Strategies and Practices 3
- COMM 409 Sustainability Measurement, Implementation and Evaluation 3
- COMM 495 Project Management 3
- ECON 110 Principles of Economics 6
- ECON 111 Introductory Microeconomics 3
- ECON 112 Introductory Macroeconomics 3
- ECON 239 Economic Development F | 3
- ECON 240 Canadian Tax Policy W | 3
- ECON 261 Canadian Labour Relations F | 3
- ECON 290 Environmental Economics and Assessment F | 3
- ELEC 221 Electric Circuits F | 4.25
- ELEC 252 Electronics I W | 4.25

- ELEC 270 Discrete Mathematics with Computer Engineering Applications W | 3.5
- ELEC 271 Digital Systems F | 4
- ELEC 274 Computer Architecture W | 4
- ELEC 278 Fundamentals of Information Structures F | 4
- ELEC 280 Fundamentals of Electromagnetics W | 3.75
- ELEC 333 Electric Machines F | 4.5
- ELEC 431 Power Electronics F | 3.25
- ENSC 201 Environmental Toxicology and Chemical Risks W
- ENSC 301 Environmental Assessment W
- ENSC 305 Social Environments W
- ENSC 321 Environmental Justice in Global Context F
- ENSC 390 Sustainability W
- GEOE 221 Geological Engineering Field Methods F | 5
- GEOE 249 Geophysical Characterization of the Earth W | 3.5
- GEOE 319 Applied Geophysics W | 4.5
- GEOE 333 Terrain Evaluation W | 4
- GEOE 365 Geochemical Characterization of the Earth F | 4
- GEOE 463 Spatial Information Management in the Geosciences F | 3.5
- GEOE 475 Exploration and Environmental Geochemistry F | 4.3
- GEOE 481 Structural Analysis Applied to Resource Deposits W | 3.5
- GPHY 242 Remote Sensing I: Image Interpretation and Measurement 3-0-0 3
- GPHY 243 Geographic Information Science 3-0-2 4
- GPHY 304 Arctic and Periglacial Environments W | 3
- GPHY 312 Watershed Hydrology 3-0-3 4.5
- GPHY 342 Remote Sensing II: Digital Image Processing 2-0-0 2
- GPHY 345 Spatial Analysis 2-2-0 4
- GPHY 346 Environmental Modeling 2-2-0 4
- GPHY 351 Aboriginal Geographies of Canada 3-0-0 3
- LAW 201 Introduction to Canadian Law
- LAW 207 International Law
- LAW 202 Aboriginal Law
- LAW 203 Workplace Law
- Law 206 Intellectual Property Law
- MECH 270 Materials Science and Engineering F | 3.5
- MECH 323 Machine Design W | 4.5
- MECH 370 Principles of Materials Processing F | 3.5
- MECH 435 Internal Combustion Engines W | 3.5
- MECH 456 NOT OFFERED 2019-2020 - Introduction to Robotics F | 3.5
- MECH 465 Computer-Aided Design F | 3.5
- MECH 495 Ergonomics and Design W | 3.5

## **Mining Engineering Technology, BTech**

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The modern mining industry is concerned with the stewardship and recovery of the earth's mineral resources in an economic and sustainable manner, while also adhering to ethical and social values. Mining professionals have to be technically proficient, work safely, have business and management skills, recognize and mitigate negative environmental effects, understand the interests of local communities, and design for sustainability. The Bachelor of Mining Engineering Technology curriculum has been designed to provide technical, managerial, and sustainability skills, as well as develop an understanding of the business of mining in terms of economics, finance, and people. Recognizing that technical competence is key to the business of mining, these competencies will be emphasized by providing the necessary fundamental background in science and mathematics, and reinforced through a two-week hands-on field school placement, occurring in the summer of each year (one in Kingston, the other in Timmins), which will also serve to enhance the development of applied skills and theoretical concepts. Ultimately, the curriculum is designed to produce experienced mining professionals with technical hands-on communication and business skills, sensitive to the values of society, and with an ability to adapt to the future needs of the industry.

### **Progression:**

- *All curriculum may be completed at either a full-time or part-time pace.*
- *Courses are group-paced, delivered asynchronously, and are 12 weeks in length.*
- *Upon enrolment, students must complete a customized bridge curriculum (offered via distance delivery), before progressing into Year 3 of the program.*
- *Years 3 and 4 will each contain 12 courses (also offered via distance delivery - pending curriculum committee approval).*
- *Upon completion of each year's curriculum, students will then be required to complete a two-week, laboratory intensive field placement, consisting of a series of labs based on the year's curriculum.*

### **Mining Engineering Technology, BTech**

#### Bridge Curriculum

- MNTC P01 Engineering Mathematics O/L | 3
- MNTC P02 Mining Geology O/L | 3
- MNTC P03 Foundational Mathematics O/L | 3
- MNTC P04 Calculus O/L | 3
- MNTC P05 Foundational Physics O/L | 3
- MNTC P06 Foundational Chemistry O/L | 3
- MNTC P07 Surveying Principles O/L | 3

#### Third Year Curriculum

- APSC 221 Economics and Business Practices in Engineering F/W/S | 3
- MNTC 301 Technical Writing and Communication O/L | 3
- MNTC 302 Engineering Physics O/L | 3
- MNTC 303 Engineering Chemistry O/L | 3
- MNTC 304 Applied Metrology and Data Analysis O/L | 3



- MNTC 305 Introduction to Mining O/L | 3
- MNTC 306 Mineral Processing Unit Operations O/L | 3
- MNTC 307 Geomechanics and Ground Control O/L | 3
- MNTC 310 Mining and Society O/L | 3
- MNTC 311 Ore Body Modelling and Resource Estimation O/L | 3
- MNTC 313 Introduction to Programming O/L | 3
- MNTC 314 Drilling and Blasting O/L | 3
- MNTC 316 Ventilation and Hydraulics O/L | 3
- MNTC 399 Field School I (on site) S | 5

## Fourth Year Curriculum

- LAW 204 Corporate Law
- MNTC 408 Mine Health and Safety O/L | 3
- MNTC 409 Mineral Economics O/L | 3
- MNTC 413 Surface Mine Planning O/L | 3
- MNTC 414 Underground Mine Planning O/L | 3
- MNTC 415 Metal Extraction Processes O/L | 3
- MNTC 418 Sustainability and the Environment O/L | 3
- MNTC 419 Mine Supervision and Project Management O/L | 3
- MNTC 420 Physical Asset Management O/L | 3
- MNTC 423 Geomatics O/L | 3
- MNTC 498 Capstone Project O/L | 3
- MNTC 499 Field School II (on site) S | 5

## Complementary Studies

Complementary Studies complement the technical content of a student's curriculum, and are sub-divided into **six areas of study**:

- Engineering Economics (EEC);
- Communications (CMC);
- List A Courses: Humanities and Social Sciences (H&SS);
- List B Courses: Linkage and Professional Issues (LNK);
- List C Courses: Performance Arts and Languages (PAL); and
- List D Courses: Management, Business, and Law (MBL).

In all academic plans in the Faculty students must complete courses in Complementary Studies amounting to at least 18.75 credits. All of the academic plans in the Faculty have courses in Complementary Studies built into the CORE of the curriculum, and/or have portions of technical courses assigned to topics in Complementary Studies. The exact requirements vary from plan to plan, the details are provided in the curriculum for each Academic Plan.

Students **MUST** complete a minimum number of credits in some of the above six areas of study. Some of these credits are obtained in faculty-wide core courses while others may be drawn from a list of elective courses. The table below shows the credits in the core courses and lists of elective courses from which additional required credits must be drawn. The lists are updated each year, and a course qualifies as a Complementary Studies course only if it appears on the list for the Academic Session in which the course is taken.

Area of Study	Core Courses	Credits in core courses	List of additional courses	Total required credits
Engineering Economics	APSC 221, APSC 321 OR CHEE 310 <sup>1</sup>	3		3
Communications	APSC 100, APSC 293	2	See note 2 below	3
Humanities and Social Science (H&SS)		0	List A	6
Linkage and Professional Issues (LNK)	APSC 100, APSC 151, APSC 200 <sup>3</sup>	3	List B	3.5
Any combination of H&SS, LNK, PAL, or MGT			List A, B, C, or D	3
<b>TOTAL</b>				<b>18.5</b>

<sup>1</sup>Note: At the end of each Academic Plan listing in the Calendar there is an explanation of which courses may be taken to meet the requirement for engineering economics.

<sup>2</sup>Note: At the end of each Academic Plan listing in the Calendar there is an explanation of which additional courses must be taken to meet the total credit requirement for Communications.

<sup>3</sup>Note: for the graduating class of 2014 and later, an additional 1 credit of Linkage and Professional issues will be delivered in third and fourth year courses in the Engineering Design and Practice Sequence, satisfying the requirement for 3.5 credit total. In special cases APSC 191 can be used to satisfy the required 3.5 credit of linkage by permission. For the graduating classes of 2013 and earlier, the required 3.5 credit was met by APSC 190 (no longer offered) or APSC 191.

Note that the credits in the table above add up to 18.5 credits, so an additional .25 credit of complementary studies are needed to reach the requirement of 18.75 credits. In many academic plans this additional .25 credit is provided by other upper year engineering courses, but it is the student's responsibility to check.

## Engineering Economics Courses:

Engineering Economics courses introduce students to the economic analysis of engineering projects. Each student must take a minimum of 3 credits in Engineering Economics. At the end of each Degree Program listing in the Calendar there is an explanation of how students in that Program meet this requirement.

- APSC 221 Economics and Business Practices in Engineering F/W/S | 3
- CHEE 310 Deleted-Engineering Innovation and Entrepreneurship F | 3.5

## Communications Courses:

The ability to communicate effectively, both orally and in writing is critical for all engineers. This is developed within each Department's curriculum in a variety of ways, including the evaluation of written reports and oral presentations. There are also courses designed specifically to improve a student's ability to communicate in English; these are listed below. In some programs one or more of these courses may be included in the core of the program.

Each student must take a minimum of 3 CR in Communications. At the end of each Academic Program listing in the Calendar there is an explanation of how students in that Program meet this requirement.

- APSC 293 Engineering Communications I F/W | K1
- CHEE 361 Engineering Communications, Ethics & Professionalism W | K1
- CIVL 200 Professional Skills I F | K 2.5
- CIVL 300 Professional Skills II F | K 2.5
- CIVL 400 Professional Skills III F | 2.5
- MECH 464 Communications and Project Management F | 1.5
- MINE 434 Project Report F/W | 4
- MTHE 494 Mathematics and Engineering Seminar F | 3
- ENPH 455 Engineering Physics Thesis FW | 4

## List A – Humanities and Social Sciences:

Students must take a minimum of 6 credits in Humanities and Social Sciences from List A, and an additional 3 credits from List A, B, C or D.

Courses in LIST A introduce students to subject matter that deals with central issues, methodologies, and thought processes of the humanities and social sciences.

**NOTE:** A course will be accepted as a Humanities and Social Sciences (H&SS) credit only if it appears on the list of approved H&SS courses for the Academic Session in which the course is taken.

The following are the courses approved as H&SS credits for the Academic Session 2018-2019:

Art (ARTH only **except** ARTH 245, 395 and any 4th level)

Biomedical and Molecular Sciences (GLPH 271 only)

Classics (all CLST **except** 401, 410, 411, 420, 421; GREK 208, 321, 322, 421, 422, and 430; LATN 209, 310, 321, 322, 327, 421 and 422)

Commerce (COMM 251 and 651)

Development Studies (all DEVS **except** 292, 293, 4XX)

Drama (DRAM 100, 200, 205, 211, 220, 251, 300, 303, 306, 310, 311, 371, 375, and 381)

Economics (all ECON **except** ECON 250, 255, 322, 437, 445, 450, and 455; PPEC 200, 400)

English language and literature (all ENGL; CWRI 397; ENGX 287)

Entrepreneurship and Innovation (ENIN 140, 240, 301, and 340)

Environmental Studies (ENSC 290, 305, 310, 315, 321, 420, and 490)

Film Studies (FILM 104, 106, 110, 204, 206, 210, 215, 216, 220, 225, 226, 236, 240, 260 (formerly 315), **except** 3XX and 4XX)

French (FREN, 241, 285, 290, 304, 305, 306, 315, 323, 324, 325, 327, 335, 342, 343, 350, 351, 352, 363, 387/487, 388, 390/490, 391, 394, 395, 396, 406, 424, and 477) (FRST 290, 294)

Geography (GPHY 203, 227, 228, 229, 250, 254, 257, 258, 259, 325, 327, 332, 336, 337, 338, 339, 351, 352, 362, 365, and 368, 370)

Gender Studies (all GNDS **except** 4XX)

German Language and Literature (GRMN 308, 309, 311, 312, 317, 419, 420, 426, 427, 429, and 433)

Hebrew (HEBR 292 and 393)

History (all HIST **except** HIST 257, 3XX and 4XX)

Health (HLTH 101, 235 and 270)

Industrial Relations (EMPR 260)

Interdisciplinary Studies (IDIS 302-305)

International Studies (all INTS **except** 324)

Jewish Studies (all JWST)

Languages, Literatures & Cultures (LLCU 110, 200, 201, 205, 207, 209, 210, 213, 214, 215, 226, 232, 233, 234, 244, 247, 248, 257, 270, 301, 302, 303, 308, 309, 316, 319, 320, 322, 326, 327, 328, 329, 330, 331, 332, 333, 340, 354, 358, 370, 495; ANSH 101, 203, 208, 303; INDG 301; INUK 102)

Law (LAW 201, 205 and 207 only)

Linguistics (LING 202, 205, 350, and 475)

Music (MUSC 102, 114, 171, 210, 286, 289, 328, 333, 334, 335, 338, 380, 381, 388, 393, 438, 445, 446, 470, 473, 474, 475, 476, 477, 480, 481, 485, 486, 490, 491, 592)

Music Theatre (MUTH 110, 111, 160, 201, 211, 231, 232, 240, and 329)

Philosophy (all PHIL **except** 390 and 4XX)

Physical and Health Education (HLTH 101, 237, 239, 333, 334, and 405)

Political Studies (all POLS **except** POLS 385 and 4XX)

Psychology (PSYC 100, 101, 102, 103, 215, 221, 231, 235, 241, 251, 321, 333, 335, 342, 350, 355, 360, 380, 397, 400, 420, 423, 430, 433, 435, 436, 437, 440, 441, 442, 443, 450, 452, 453, 455, and 456)

Religious Studies (all RELS **except** 4XX)

Sociology (SOCY 122, 200, 210, 211, 225, 226, 227, 235, 273, 275, 276, 300, 301, 303, 305, 306, 309, 310, 321, 336, 344, 352, 354, 362, 384, 387, 388, 389, 401, 402, 403, 404, 422, 424, 430, 431, 454, 457, 458, 472, and 476)

Spanish and Italian (SPAN 306, 310, 330, 331, 332, 344, 351, 352, 354, 380, 381, 406, 428, 458, 495, and 496; ITLN 310, 331, 332, 357, 408, 415, and 432)

## **List B Linkage and Professional Issues**

The courses in LIST B are designed to expose students to two inter-related areas: 1) Linkage (the impact of technology on society) and 2) Professional Issues (the role and responsibility of the professional engineer in society).

**For students first registering in first year engineering in September 2010 and later:**

Linkage and Professional issues content will be included as part of the Engineering Design and practice sequence courses included in each year of the program.

### **For all other students:**

Students require a minimum of 3.5 credits in Linkage and Professional Issues. Upper year and transfer students who will not be taking courses in the Engineering Design and Practice Sequence will meet the minimum requirement of 3.5 credits in Linkage and Professional issues by taking having either APSC 190 (no longer offered). APSC 191 can be used to satisfy the required 3.5 credits of linkage by permission.

### **For all students:**

*Once these Linkage and Professional Issues requirements have been fulfilled* all students may take other courses from List B below to help complete their Complementary Studies requirements. Note that these courses cannot be used to fulfill any part of the minimum Linkage and Professional Issues requirement of 3.5 credits.

**NOTE:** A course will be accepted as a Linkage credit only if it appears on the list of approved Linkage courses for the Academic Session in which the course is taken. The following are the courses approved as PAL credits for the Academic Session 2018-2019.

- BIOL 111 Ecology and the Environment 3
- ENIN 205 Innovation for STEAM 3
- ENSC 103 Environment and Sustainability 3
- ENSC 200 Environmental History 3
- ENSC 201 Environmental Toxicology and Chemical Risks 3
- ENSC 203 Environment and Sustainability 3
- ENSC 301 Environmental Assessment 3
- ENSC 320 Wildlife Issues in a Change World 3
- ENSC 390 Sustainability 3
- GPHY 101 Human Geography 3
- GPHY 210 Geographical Perspectives on Global Change 3
- HIST 257 Environmental History 3
- MECH 333 -NOT OFFERED 2019/2020 - Gender, Engineering and Technology W | 3
- MINE 462 Occupational Health and Safety in Mining Practice w | 3.5
- SOCY 284 Sociology of Information and Communication Technology 3
- SOCY 363 Science, Technology and Society 3
- COMM 409 Sustainability Measurement, Implementation and Evaluation 3

Students must take a minimum of 6 credits in Humanities and Social Sciences from List A, and an additional 3 credits from List A, B, C or D.

### **LIST C - Performance Arts and Languages**

Courses in LIST C deal with performance in the various arts media (e.g. art, music, drama, film, creative writing) and in languages other than English.

**NOTE:** A course will be accepted as a Performance Arts and Language (PAL) credit only if it appears on the list of approved PAL courses for the Academic Session in which the course is taken.

The following are the courses approved as PAL credits for the Academic Session 2018-2019:

Arabic (ARAB 100, 200)

Art (ARTF only)

Art History (ARTH 485)

Chinese Language (CHIN 100, 200 and 300)

Classics (GREK 112; LATN 110)

Commerce (COMM 290)

Creative Writing (CWRI 293-296)

Drama (DRAM 220, 236, 237, 238, 239, 241, 246, 247, 271, 273, 314, 318, 323, 331, 332, 339, 342, 344, 345, 348, 350, 351, 371, 373, 400, 439, and 451; STSC 300 and 309)

Film Studies (FILM 250, 304, 312, 355, 360, 365, 375, 410, 450, 451 and 456)

French Studies (FREN 011, 012, 016, 017, 100, 101, 102, 106, 107, 111, 112, 118, 150, 219, 225, 230, 236, 237, 238, 250, 283, 320, 330, 331, 353, 373, 393, 444, 450, 463, 473, and 493) and FRST 105 and 125

German Language and Literature (GRMN 101, 102, 201, 202, 203, 306, 307, 312)

Hebrew (HEBR 190, 192, 193, 294, 295, and 301)

Interdisciplinary Studies (IDIS 201, and 311)

Japanese Language (JAPN 100, 200, 301, and 302)

Languages, Literatures and Cultures (LLCU 101, 102; LANG 101, 102, 201, 202, MOHK 101, 102, 201, 202; INUK 101; ANSH 102)

Linguistics (LING 100, 310, 320, 330, 340, 415, 435, and 475)

Multi-Disciplinary (MDEP 400)

Music (MUSC 100, 104, 112, 115, 120, 121, 124, 125, 127, 129, 151, 152, 156, 180, 181, 183, 185, 187, 188, 189, 191, 200, 212, 215, 220, 221, 224, 225, 227, 229, 245, 253, 255, 270, 274, 280, 281, 283, 285, 292, 293, 300, 312, 315, 320, 321, 324, 325, 326, 351, 352, 354, 355, 358, 392, 394, 396, 398, 399, 400, 412, 415, 420, 421, 424, 425, 443, 446, 451, 452, 454, 455)

Music Theatre (MUTH 320, 380, 387, and 440)

Portuguese (PORT 103 and PORT 104)

Spanish and Italian (SPAN 111, 112, 204, 205, 206, 301, 302, 303, 304, 401, and 402; ITLN 111, 112, 204, 205)

## **List D – Management, Business, and Law Courses**

Courses which relate to management issues can be found in the in the School of Urban and Regional Planning (SURP) and in the School of Business (COMM). Some programs require or permit students to take one or more of these Management courses from the lists below.

## **Management Courses Offered by the Faculty of Engineering and Applied Science**

- APSC 223 Global Project Management S | K3
- CHEE 302 Technical Entrepreneurship W/OL, F/OL, S/OL | K3.5

### **Management Courses Offered by the School of Urban and Regional Planning**

- SURP 851 Environmental Policy W | 3
- SURP 853 Environmental Services W | 3
- SURP 855 Environmental Planning and Management W | 3

### **Management Courses Offered by the School of Business**

- COMM 200 Introduction to Business 3
- COMM 201 Introduction to Business for Entrepreneurs
- COMM 211 Introduction to Financial Accounting 3
- COMM 212 Introduction to Management Accounting 3
- COMM 221 Introduction to Finance 3
- COMM 226 Comparative Financial Institutions 3
- COMM 231 Introduction to Marketing 3
- COMM 244 Project Management: An Engineering Economics Perspective 3
- COMM 251 Organizational Behaviour 3
- COMM 290 Empowering Business with Information Technology
- COMM 303 Business and Ethics 3
- COMM 305 Introduction to Entrepreneurship 3
- COMM 308 Canadian Business History 3
- COMM 310 Environmental Accounting 3
- COMM 311 Financial Accounting Practices, Principles and Concepts 3
- COMM 312 Intermediate Management Accounting 3
- COMM 313 Financial Accounting II 3
- COMM 322 Financial Management 3
- COMM 323 Corporate Financial Planning 3
- COMM 325 Financial Modelling 3
- COMM 326 The Economics of Canada's Financial System 3
- COMM 328 International Finance 3
- COMM 329 Management of Financial Institutions 3
- COMM 351 Leadership 3
- COMM 353 Managing in a Multicultural Environment 3
- COMM 357 Interpersonal Skills for Managers 3
- COMM 375 International Business 3
- COMM 381 Business Law I 3
- COMM 382 Business Law II 3
- COMM 387 The Behavioural Study of Unions 3
- COMM 408 Sustainability Strategies and Practices 3
- COMM 496 IS Security, Privacy and Ethics 3

### **Management Courses Offered by the Faculty of Arts and Science/ School of Industrial Relations**

- DEVS 333 Business and Global Development
- EMPR 100 Introduction to Employment Relations
- EMPR 200 Work and Employment Relations in Canada
- EMPR 210 Employment Relations and Labour Law
- EMPR 220 Conflict Resolution
- EMPR 230 Managing Human Resources and Employment Relations
- EMPR 240 Labour Policy
- EMPR 250 Managing Workplace Health, Safety, and Wellness
- EMPR 320 Workplace Mediation and Alternative Dispute Resolution
- EMPR 330 Strategic HR Management: Building High Performance Workplaces
- EMPR 335 Managing Employee Attitudes for Organizational Success
- EMPR 370 Human Resource Analytics
- ENIN 200 Foundations of Entrepreneurship
- ENIN 204 Publicity and Media Relations
- ENIN 207 Envisioning Disruptive Technologies
- MUTH 340 Arts Professionalism

## **Law Courses Offered by the Faculty of Law**

- LAW 201 Introduction to Canadian Law (Can be used as a List A OR a List D)
- LAW 202 Aboriginal Law
- LAW 203 Workplace Law
- LAW 204 Corporate Law
- LAW 205 Public and Constitutional Law
- LAW 206 Intellectual Property Law
- LAW 207 International Law

## **Courses of Instruction**

**APSC 100 Engineering Practice I FW | K9**

**APSC 101 Engineering Problem Solving and Modeling F | K2.9**

**APSC 102 Experimentation and Design F/W | K2.8**

**APSC 103 Engineering Design Project W | K3.3**

**APSC 111 Physics I F | 3.3**

**APSC 112 Physics II W | 3.3**

**APSC 114 Electricity and Magnetism W | 3.3**

**APSC 131 Chemistry and Materials F | 3.3**

**APSC 132 Chemistry and its Applications W | 3.3**

**APSC 142 Introduction to Computer Programming for Engineers F/W | 3**



**APSC 143 Introduction to Computer Programming for Engineers F | 3.3**

**APSC 151 Earth Systems Engineering F | 3.3**

**APSC 161 Engineering Graphics W | 3.5**

**APSC 162 Engineering Graphics W | 2.5**

**APSC 171 Calculus I F | 3.3**

**APSC 172 Calculus II W | 3.3**

**APSC 174 Introduction to Linear Algebra W | 3.3**

**APSC 182 Applied Engineering Mechanics W, F | 1.7**

**APSC 191 Deleted - Professional Engineering Skills FW | 3.5**

**APSC 199 English Proficiency for Engineers FW, S | K0.2**

**APSC 200 Engineering Design and Practice II F/W | K4**

**APSC 202 Engineering Design and Practice II: Client-Based Design W | K4**

**APSC 221 Economics and Business Practices in Engineering F/W/S | 3**

**APSC 223 Global Project Management S | K3**

**APSC 250 Biology Through an Engineering Lens S/OL | K3.5**

**APSC 262 NOT OFFERED THIS YEAR: Engineering Surveying | 3.25**

**APSC 291 NOT OFFERED THIS YEAR: Engineering Communications I F | 1**

**APSC 292 Deleted - Engineering Communications II W | 1.25**

**APSC 293 Engineering Communications I F/W | K1**

**APSC 301 Professional Internship | 3.0**

**APSC 302 Professional Internship | 3.0**

**APSC 303 Professional Internship | 3.0**

**APSC 304 Professional Internship | 3.0**

**APSC 321 Deleted - Economic and Business Practices in Mining and Geological Engineering |**

**APSC 381 Advanced Design and Skills for Innovation W | K3.5**

**APSC 400 Technology, Engineering & Management (TEAM) FW\* | 7 K7**

**APSC 480 Multi-disciplinary Industry Engineering Design Project FW | K9**

**BCHM 315 Proteins and Enzymes F | 3**

**BIOL 205 Mendelian and Molecular Genetics F | 3**

**BIOL 335 Limnology and Aquatic Ecology F | 3**

**CHEE 209 Analysis of Process Data F | 3.5**

**CHEE 210 Thermodynamics of Energy Conversion Systems W | 3.5**

**CHEE 218 Laboratory Projects I W | 2.5**

**CHEE 221 Chemical Processes and Systems F | 3.5**

**CHEE 222 Process Dynamics and Numerical Methods W | 3.5**

**CHEE 223 Fluid Mechanics W | 3.5**

**CHEE 224 NOT OFFERED 2019-2020 Transport Phenomena Fundamentals F | 3**

**CHEE 229 Cell Based Engineering Principles F | 4**

**CHEE 270 ChemEtronics F | K3**

**CHEE 302 Technical Entrepreneurship W/OL, F/OL, S/OL | K3.5**

**CHEE 310 Deleted-Engineering Innovation and Entrepreneurship F | 3.5**

**CHEE 311 Fluid Phase and Reaction Equilibrium F | 3.5**

**CHEE 315 Laboratory Projects II F/W | 4**

**CHEE 319 Process Dynamics and Control W | 3.5**

**CHEE 321 Chemical Reaction Engineering F | 3.5**

**CHEE 323 Industrial Catalysis w | 3.5**

**CHEE 324 Organic Process Development W | 3.5**

**CHEE 330 Heat and Mass Transfer F | 3.5**

**CHEE 331 Design of Unit Operations w | K 4.5**

**CHEE 332 Design of Unit Operations (DELETED) W | K 4.5**

**CHEE 333 Design of Unit Operations (DELETED) W | K 4.5**

**CHEE 340 Biomedical Engineering W | 3.5**

**CHEE 342 Environmental Biotechnology F | 3.5**

**CHEE 360 Deleted - Technical Communications W | 1.5**

**CHEE 361 Engineering Communications, Ethics & Professionalism W | K1**

**CHEE 363 Electrochemical Engineering\* W | 3.5**

**CHEE 370 Deleted - Waste Treatment Processes W | 3.5**

**CHEE 371 Mitigation of Industrial Pollution W | 3.5**

**CHEE 380 Biochemical Engineering F | 3.5**

**CHEE 400 DELETED Technology, Engineering & Management (TEAM) FW | K7**

**CHEE 405 Biochemical/Biomedical Research Project FW | 7**

**CHEE 406 Bioenvironmental Research Project FW | 7**

**CHEE 407 Deleted - Biochemical/Biomedical/Bioenvironmental Research Seminar W | 3**

**CHEE 408 Bioengineering Research Project FW | K7**

**CHEE 410 NOT OFFERED 2019-2020 Engineering Innovation and Entrepreneurship W | K4**

**CHEE 412 Transport Phenomena W | 3.5**

**CHEE 414 Foundations of the Oil and Gas Industry w | 3.5**

**CHEE 418 Strategies for Process Investigations F | 3.5**

**CHEE 420 Laboratory Projects III F/W | K 4**

**CHEE 421 Research Project FW | K 7**

**CHEE 434 Process Control II W | 3.5**

**CHEE 436 Deleted-System Identification F | 3.5**

**CHEE 440 Pharmaceutical Technology W | 3.5**

**CHEE 450 DELETED - Engineering Biology W | 3.5**

**CHEE 452 Transport Phenomena in Physiological Systems F | 3.5**

**CHEE 460 Applied Surface and Colloid Science F | 3.5**

**CHEE 463 NOT OFFERED 2019-2020 Electrochemical Energy Systems W | 3.5**

**CHEE 470 Design of Manufacturing Processes F | K 7**

**CHEE 471 Chemical Process Design FW | K7**

**CHEE 481 DELETED - Air Quality Management W | 3.5**

**CHEE 484 NOT OFFERED 2019-2020 Bioremediation W | 3.5**

**CHEE 490 Polymer Formulations and Processing Technology W | 3.5**

**MICR 360 Immunology F | 3**

**CIVL 200 Professional Skills I F | K 2.5**

**CIVL 201 Professional Skills F/W | 2.5**

**CIVL 210 Chemistry for Civil Engineers F | 4.5**

**CIVL 215 Materials for Civil Engineers W | 4.5**

**CIVL 220 Deleted - Statics and Solid Mechanics F | 4**

**CIVL 222 Numerical Methods for Civil Engineers W | 5**

**CIVL 230 Solid Mechanics I F | 4.25**

**CIVL 231 Solid Mechanics II W | 4.5**

**CIVL 250 Hydraulics I W | 4**

**CIVL 260 Deleted - Civil Engineering Design I F | 4**

**CIVL 300 Professional Skills II F | K 2.5**

**CIVL 330 Structural Analysis F | 3.75**

**CIVL 331 Structural Steel Design W | 4**

**CIVL 340 Geotechnical Engineering I F | 3.75**

**CIVL 341 Geotechnical Engineering II W | 4**

**CIVL 350 Hydraulics II F | 3.75**

**CIVL 360 Civil Engineering Design and Practice III W | K4**

**CIVL 370 Deleted - Fundamentals of Environmental Engineering |**

**CIVL 371 Groundwater Engineering F | 3.75**

**CIVL 372 Water and Wastewater Engineering W | 4**

**CIVL 380 Deleted - Applied Sustainability and Public Health in Civil Engineering |**

**CIVL 400 Professional Skills III F | 2.5**

**CIVL 409 Deleted - Engineering Report F | 3.5**

**CIVL 430 Reinforced Concrete Design F | 3.75**

**CIVL 431 Infrastructure Rehabilitation W | 4**

**CIVL 436 Prestressed Concrete W | 4**

**CIVL 442 Geotechnical Design F | 3.75**

**CIVL 443 Geoenvironmental Design W | 4**

**CIVL 450 Municipal Hydraulics F | 3.75**

**CIVL 451 Lake, Reservoir and Coastal Engineering F | 3.75**

**CIVL 455 River Engineering F | 4**

**CIVL 460 Civil Engineering Design and Practice IV FW | K6**

**CIVL 470 Deleted - Municipal Water Engineering |**

**CIVL 471 Subsurface Contamination W | 4**

**CIVL 472 Deleted - ENV TE II: Waste Management |**

**CIVL 473 Water Resources System W |**

**CIVL 500 Civil Engineering Thesis FW | K4**

**CMPE 204 Logic for Computing Science F/W | 3**

**CMPE 212 Introduction to Computing Science II F/W | 4**

**CMPE 223 Software Specifications W | 3**

**CMPE 251 Data Analytics F | 3**

**CMPE 271 Scientific Computing W | 3**

**CMPE 320 Fundamentals of Software Development F | 4**

**CMPE 322 Software Architecture F | 4**

**CMPE 324 Operating Systems W | 3**

**CMPE 325 Human-Computer Interaction W | 3**

**CMPE 326 Game Architecture DELETED F | 4**

**CMPE 327 Software Quality Assurance F | 3**

**CMPE 330 Computer-Integrated Surgery F | 3**

**CMPE 332 Database Management Systems W | 3**

**CMPE 333 DELETED Data Analytics F | 3**

**CMPE 351 Advanced Data Analytics W | 3**

**CMPE 365 Algorithms I F | 4**

**CMPE 422 Formal Methods in Software Engineering F | 3**

**CMPE 425 NOT OFFERED 2019-2020 Advanced User Interface Design W | 3**

**CMPE 432 NOT OFFERED 2019-2020 Advanced Database Systems F | 3**

**CMPE 434 NOT OFFERED THIS YEAR: Distributed Systems F | 3**

**CMPE 452 Neural Networks and Genetic Algorithms F | 3**

**CMPE 454 Computer Graphics W | 3**

**CMPE 457 Image Processing and Computer Vision F | 3**

**CMPE 458 Programming Language Processors W | 4**

**CMPE 471 Computational Biology F | 3**

**CMPE 472 Medical Informatics W | 3**

**CMPE 480 Deleted - Computational Biology Laboratory W | K 1**

**ELEC 210 DELETED Introductory Electric Circuits and Machines W | 4.25**

**ELEC 221 Electric Circuits F | 4.25**

**ELEC 224 Continuous-Time Signals and Systems W | 3.75**

**ELEC 252 Electronics I W | 4.25**

**ELEC 270 Discrete Mathematics with Computer Engineering Applications W | 3.5**

**ELEC 271 Digital Systems F | 4**

**ELEC 273 NOT OFFERED 2019-2020 Numerical Methods and Optimization W | 3.5**

**ELEC 274 Computer Architecture W | 4**

**ELEC 278 Fundamentals of Information Structures F | 4**

**ELEC 279 Introduction to Object Oriented Programming W | 4**

**ELEC 280 Fundamentals of Electromagnetics W | 3.75**

**ELEC 293 Deleted - Electrical and Computer Engineering Laboratory I |**

**ELEC 294 Deleted - Electrical and Computer Engineering Laboratory II |**

**ELEC 299 Mechatronics Project W | K1.5**

**ELEC 310 DELETED 2018-2019 -Introductory Analog Electronic and Digital Circuits F | 4.5**

**ELEC 323 Continuous-Time Signals and Systems F | 3.75**

**ELEC 324 Discrete-Time Signals and Systems W | 4**

**ELEC 326 Probability and Random Processes F | 3.5**

**ELEC 333 Electric Machines F | 4.5**

**ELEC 344 Sensors and Actuators F | 3.75**

**ELEC 353 Electronics II F | 4.25**

**ELEC 371 Microprocessor Interfacing and Embedded Systems F | 4**

**ELEC 372 NOT OFFERED 2019-2020 Numerical Methods and Optimization W | 3.5**

**ELEC 373 Computer Networks W | 3.5**

**ELEC 374 Digital Systems Engineering W | 4.25**

**ELEC 377 Operating Systems F | 4**

**ELEC 381 Applications of Electromagnetics F | 3.75**

**ELEC 390 Principles of Design and Development W | K3.5**

**ELEC 408 Biomedical Signal and Image Processing W | 3**

**ELEC 409 NOT OFFERED 2019-2020 Bioinformatic Analytics W | 3**

**ELEC 421 Digital Signal Processing: Filters and System Design F | 4**

**ELEC 422 NOT OFFERED 2019-2020 Digital Signal Processing: Random Models and Applications F | 3**

**ELEC 425 Machine Learning and Deep Learning F | 3.5**

**ELEC 431 Power Electronics F | 3.25**

**ELEC 433 Energy and Power Systems W | 3.5**

**ELEC 436 NOT OFFERED 2019-2020 Electric Machines and Control W | 3**

**ELEC 443 Linear Control Systems F | 4.25**

**ELEC 444 NOT OFFERED 2019-2020 Modeling and Computer Control of Mechatronic Systems W | 3.25**

**ELEC 448 Introduction to Robotics: Mechanics and Control W | 3.5**

**ELEC 451 Digital Integrated Circuit Engineering W | 3.25**

**ELEC 454 Analog Electronics W | 3.25**

**ELEC 457 NOT OFFERED 2019-2020 Integrated Circuits and System Applications F | 3.25**

**ELEC 461 NOT OFFERED 2019-2020 Digital Communications F | 3.5**

**ELEC 464 Wireless Communications F | 3**

**ELEC 470 NOT OFFERED 2019-2020 Computer System Architecture W | 3.5**

**ELEC 472 Artificial Intelligence and Interactive Systems W | 3.5**

**ELEC 474 Machine Vision F | 3.5**

**ELEC 476 DELETED - Modelling and Systems Simulation W | 3.5**

**ELEC 478 DELETED - Computer Networks II W | 3**

**ELEC 483 NOT OFFERED 2019-2020 Microwave and RF Circuits and Systems W | 4.25**

**ELEC 486 Fiber Optic Communications W | 3.75**

**ELEC 490 Electrical Engineering Project FW | K7**

**ELEC 491 Advanced ECE Thesis I S | 6**



ELEC 492 Advanced ECE Thesis II FW | 6

ELEC 497 Research Project FW/S | K3.5

ELEC 498 Computer Engineering Project FW | K7

SOFT 423 Software Requirements W | 3

SOFT 437 NOT OFFERED 2019-2020 - Performance Analysis W | 3

ENCH 211 Main Group Chemistry F | 4.75

ENCH 212 Principles of Chemical Reactivity F | 3.75

ENCH 213 Introduction to Chemical Analysis F | 4.5

ENCH 222 Methods of Structure Determination W | 3.75

ENCH 245 Applied Organic Chemistry I W | 4.75

ENCH 281 Deleted - General Organic Chemistry I F | 4.5

ENCH 311 Mechanistic Organic Chemistry F | 3.5

ENCH 312 Transition Metal Chemistry F | 3.5

ENCH 313 Quantum Mechanics F | 3.5

ENCH 321 Instrumental Chemical Analysis W | 3

ENCH 322 The Chemical Bond: Computation and Spectroscopy W | 3.5

ENCH 323 Biological Chemistry W | 3

ENCH 326 Environmental and Green Chemistry W | 3

ENCH 345 Deleted-Applied Organic Chemistry II W | 3

ENCH 397 Experimental Chemistry FW | 7

ENCH 398 Experimental Chemistry I F | 3.5

ENCH 399 Experimental Chemistry II W | 3.5

ENCH 411 Advanced Analytical Chemistry F | 3

ENCH 412 NOT OFFERED 2019-2020 - Statistical Mechanics W | 3

ENCH 413 NOT OFFERED 2019-2020 Computational Chemistry W | 3

ENCH 414 NOT OFFERED 2019-2020 - Catalysis F | 3

ENCH 415 Electrochemistry and Electrocatalysis F | 3

ENCH 417 Research Project FW | 9

ENCH 421 Advanced Methods in Physical Chemistry F | 3

ENCH 422 Synthetic Organic Chemistry W | 3.5

ENCH 423 Topics in Inorganic and Organometallic Chemistry W | 3

ENCH 424 Polymer Chemistry W | 3

ENCH 425 NOT OFFERED 2019-2020 Self-Assembly and Materials W | 3

ENPH 211 Applied Physics W | 3.5

ENPH 213 Computational Engineering Physics W | 4

ENPH 225 Mechanics W | 3.5

ENPH 239 Electricity and Magnetism W | 3.5

ENPH 242 Relativity and Quanta F | 3.5

ENPH 251 Deleted - Engineering Physics Laboratory and Statistics FW | 4.25

ENPH 252 Management of Experimental Data W | 1.25

ENPH 253 Engineering Physics Laboratory W | K3.5

ENPH 274 Deleted - Thermodynamics W | 3.5

ENPH 312 DELETED - Mathematical Methods in Physics FW | 7

ENPH 316 Mathematical Methods in Physics I F | 3.5

ENPH 317 Mathematical Methods in Physics II W | 3.5

ENPH 321 Advanced Mechanics W | 3.5

ENPH 332 Deleted - Electromagnetic Theory W | 3.5

ENPH 333 Deleted - Electronics for Scientists and Engineers |

ENPH 334 Electronics for Applied Scientists F | 5

ENPH 336 Solid State Devices W | 3.25

ENPH 344 Introduction to Quantum Mechanics F | 3.5

ENPH 345 Quantum Physics of Atoms, Nuclei and Particles W | 3.5

ENPH 351 Deleted - Engineering Physics Laboratory F | 2

ENPH 352 Deleted - Measurement, Instrumentation and Experiment Design W | 4

ENPH 353 Engineering Physics Laboratory II F | 2.5

ENPH 354 Engineering Physics Design Project W | 3.5

ENPH 372 Thermodynamics W | 3.5

ENPH 380 Deleted - Electrical and Optical Properties of Solids W | 3.25

ENPH 414 Introduction to General Relativity F | 3

ENPH 422 Deleted - Fluid Mechanics F | 3.5

ENPH 431 Electromagnetic Theory F | 3.5

ENPH 444 Advanced Quantum Physics W | 3

ENPH 450 Deleted - Advanced Physics Laboratory and Project FW | 8

ENPH 453 Advanced Physics Laboratory W | 3.5

ENPH 454 Advanced Engineering Physics Design Project F | 4.5

ENPH 455 Engineering Physics Thesis FW | 4

ENPH 456 Advanced Engineering Physics Thesis I S | 2

ENPH 457 Advanced Engineering Physics Thesis II FW | 9

ENPH 460 Laser Optics W | 3.5

ENPH 472 Statistical Mechanics W | 3.5

ENPH 479 High Performance Computing in Engineering Physics W |

ENPH 480 Solid State Physics F | 3.5

ENPH 481 Solid State Device Physics F | 3.5

ENPH 483 NOT OFFERED 2019-2020 Nanoscience and Nanotechnology W | 3.5

ENPH 487 Deleted - Surface Engineering and Analysis F | 3

**ENPH 490 Nuclear Physics F | 3.5**

**ENPH 491 NOT OFFERED 2019-2020 Physics of Nuclear Reactors F | 3.5**

**ENPH 495 Introduction to Medical Physics W | 3**

**GEOE 107 Deleted - History of Life F | 3.5**

**GEOE 207 History of Life F | 3.5**

**GEOE 211 Deleted - Geological Engineering Field Methods F | 4.5**

**GEOE 221 Geological Engineering Field Methods F | 5**

**GEOE 232 Mineralogy F | 4.5**

**GEOE 235 Genesis and Characterization of Solid Earth Materials W | 4**

**GEOE 238 Surficial Processes, Sedimentation and Stratigraphy W | 4**

**GEOE 249 Geophysical Characterization of the Earth W | 3.5**

**GEOE 262 Geological Aspects of Mineral Deposits W | 3.75**

**GEOE 281 Earth Systems Engineering F | 4**

**GEOE 282 NOT OFFERED THIS YEAR - Earth Systems Engineering II: Resources and Environment W | 3.5**

**GEOE 300 Geological Engineering Field School S | K4**

**GEOE 301 Field Studies in Geology F | 1.5**

**GEOE 310 Deleted - Geological Engineering Field School |**

**GEOE 313 Geomechanics and Engineering Geology W | 4**

**GEOE 319 Applied Geophysics W | 4.5**

**GEOE 321 Analysis of Rock Structures F | 4**

**GEOE 323 Deleted - Quaternary Glacial Geology |**

**GEOE 333 Terrain Evaluation W | 4**

**GEOE 337 Paleontology F | 3.75**

**GEOE 340 Problems in Geological Engineering F/W | 3**

**GEOE 341 Special Topics in Applied Geology S | 3**

**GEOE 343 NOT OFFERED THIS YEAR-Applied Hydrogeology F | 3.75**

**GEOE 345 Site Investigation & Geological Engineering Design W | 4**

**GEOE 349 Deleted - Applications of Quantitative Analysis in Geological Engineering W | 3.5**

**GEOE 359 Applied Quantitative Analysis in Geological Engineering F | 3.5**

**GEOE 362 Resource Engineering W | 4.5**

**GEOE 365 Geochemical Characterization of the Earth F | 4**

**GEOE 368 Carbonate Sedimentology F | 4.5**

**GEOE 401 Field Studies in Geology II F | 1.5**

**GEOE 402 Deleted - Exploration and Mining Geology Field School (two weeks) |**

**GEOE 403 Deleted - Geotechnical and Geo-Environmental Field School F | 3**

**GEOE 409 Deleted - Applied Geophysics: Laboratory F | 5**

**GEOE 410 Geological Engineering Field School F | K4**

**GEOE 413 Geomechanics and Rock Engineering Design-NOT OFFERED 2018-2019 F | 3.5**

**GEOE 414 Foundations of the Oil and Gas Industry W | 3.5**

**GEOE 418 Petroleum Geology F | 4.5**

**GEOE 419 Engineering Geophysics Field School S | K4**

**GEOE 421 Deleted - Igneous Petrology |**

**GEOE 422 Deleted - Metallogeny and Mineral Exploration |**

**GEOE 429 Deleted - Geophysical Signal Analysis and Inverse Theory W | 3.5**

**GEOE 439 Advanced Applied Geophysics F | K3**

**GEOE 445 Deleted - Site Investigation and Case Histories F | 3.5**

**GEOE 446 Engineering Design Project I F | K4**

**GEOE 447 Engineering Design Project II W | K5.5**

**GEOE 452 Instrumental Techniques Applied to the Study of Solids W | 3**

**GEOE 462 Advanced Petrogenesis and Metallogenesis W | 4.5**

**GEOE 463 Spatial Information Management in the Geosciences F | 3.5**

**GEOE 464 Visualization in Geosciences W | 1.5**

**GEOE 465 Deleted - Exploration Geochemistry W | 3.5**

**GEOE 466 Isotopes and the Environment W | 4**

**GEOE 475 Exploration and Environmental Geochemistry F | 4.3**

**GEOE 478 Terrigenous Clastic Sedimentology F | 3.5**

**GEOE 481 Structural Analysis Applied to Resource Deposits W | 3.5**

**GEOE 485 Deleted - Environmental Aqueous Geochemistry W | 3**

**GEOE 488 Geology of North America F | 3**

**GEOE 382 Deleted - Resource Engineering F |**

**GISC 201 DELETED - Geographic Information Science W | 3**

**GISC 202 DELETED - Data Collection, Management and Analysis W | 4**

**GISC 301 DELETED - Spatial Analysis F | 3**

**GISC 302 DELETED - Environmental Modelling W | 3**

**GISC 303 DELETED - Application Design and Customization in GIS F | 3**

**GPHY 304 Arctic and Periglacial Environments W | 3**

**MBIO 218 NOT OFFERED THIS YEAR-Gene Structure and Function (Molecular Biology) W | 3.25**

**MDEP 221 Deleted - Engineering and Social Justice: Critical Theories of Technological Practices W | 3**

**MDEP 437 DELETED-Fuel Cell Technology F |**

**MECH 202 Mathematical and Computational Tools for Mechanical Engineers I F | K3.5**

**MECH 203 Mathematical and Computational Tools for Mechanical Engineers II W | K3.5**

**MECH 210 Electronic Circuits and Motors for Mechatronics W | K4.5**

**MECH 212 Deleted - Design Techniques |**

**MECH 213 Manufacturing Methods F | 4.5**

**MECH 215 DELETED-Instrumentation and Measurement F | 3.5**

**MECH 216 DELETED-Instrumentation and Measurement Labs F | K2**

**MECH 217 Measurement in Mechatronics F | 4.25**

**MECH 221 Solid Mechanics I F, O/L | 4**

**MECH 228 Kinematics and Dynamics W | K3.5**

**MECH 230 Thermodynamics I F | 3.5**

**MECH 241 Fluid Mechanics I W/S-OL | 3.5**

**MECH 270 Materials Science and Engineering F | 3.5**

**MECH 271 Deleted - Materials Science and Engineering |**

**MECH 273 Materials Science and Engineering Lab W | 1.0**

**MECH 321 Solid Mechanics II F | 3.5**

**MECH 323 Machine Design W | 4.5**

**MECH 328 Dynamics and Vibration F | 3.5**

**MECH 330 Applied Thermodynamics II F | 3.5**

**MECH 333 -NOT OFFERED 2019/2020 - Gender, Engineering and Technology W | 3**

**MECH 341 Fluid Mechanics II W | 3.5**

**MECH 346 Heat Transfer W | 3.5**

**MECH 350 Automatic Control W | 3.5**

**MECH 361 Project Based Engineering: Conceive, Design, Implement and Operate W | K3.5**

**MECH 370 Principles of Materials Processing F | 3.5**

**MECH 371 Fracture Mechanics and Dislocation Theory W | 3.5**

**MECH 391 Deleted - Technical Communication - Advanced |**

**MECH 393 Biomechanical Product Development F | 3.5**

**MECH 394 Frontiers in Biomechanical Engineering W | 3.5**

**MECH 396 Mechanical and Materials Engineering Laboratory I F | K2**

**MECH 397 Mechanical and Materials Engineering Laboratory II W | K2**

**MECH 398 Mechanical Engineering Laboratory I F | K2**

**MECH 399 Mechanical Engineering Laboratory II W | K2**

**MECH 420 Vibrations W | 3.5**

**MECH 423 Introduction to Microsystems W | 3.5**

**MECH 424 Sustainable Product Design F | 3.5**

**MECH 430 NOT OFFERED 2019-2020 Thermal Systems Design W | 4**

**MECH 435 Internal Combustion Engines W | 3.5**

**MECH 437 Fuel Cell Technology F | 3.5**

**MECH 439 Turbomachinery F | 3.5**

**MECH 441 NOT OFFERED 2019/2020 - Fluid Mechanics III W | 3.5**

**MECH 444 Computational Fluid Dynamics F | 3.5**

**MECH 448 Compressible Fluid Flow F | 3.5**

**MECH 452 Mechatronics Engineering F | 5**

**MECH 455 NOT OFFERED 2019-2020 - Computer Integrated Manufacturing F | 3.5**

**MECH 456 NOT OFFERED 2019-2020 - Introduction to Robotics F | 3.5**

**MECH 458 DELETED - Machine Condition Monitoring and Fault Diagnostics F | 3.5**

**MECH 460 Team Project - Conceive and Design F | K4**

**MECH 461 Research Project W | K4**

**MECH 462 Team Project - Implement and Operate W | K3.5**

**MECH 463 Engineering Project for International Students F/W | K 2**

**MECH 464 Communications and Project Management F | 1.5**

**MECH 465 Computer-Aided Design F | 3.5**

**MECH 470 Deformation Processing W | 3.5**

**MECH 474 Deleted - Functional Ceramics |**

**MECH 475 Deleted - Structural Ceramics |**



**MECH 476 Engineering of Polymers and Composite Materials W | 3.5**

**MECH 478 Biomaterials F | 3.5**

**MECH 479 Nano-Structured Materials F | 3.5**

**MECH 480 NOT OFFERED 2019-2020 - Airplane Aerodynamics and Performance W | 3.5**

**MECH 481 Wind Energy F | 3.5**

**MECH 482 Noise Control W | 3.5**

**MECH 483 Nuclear Materials F | 3.5**

**MECH 484 NOT OFFERED 2019-2020 - Introduction to Ceramics F | 3.5**

**MECH 492 Biological Fluid Dynamics F | 3.5**

**MECH 494 Kinematics of Human Motion F | 3.5**

**MECH 495 Ergonomics and Design W | 3.5**

**MECH 496 Musculoskeletal Biomechanics F | 3.5**

**MINE 201 Introduction to Mining and Mineral Processing F | 4**

**MINE 202 Computer Applications and Instrumentation in Mining F | 1.5**

**MINE 225 Applied Rock Mechanics (Changing from MINE 325) W | 4.5**

**MINE 244 Underground Mining (changed to MINE 344) W | 3**

**MINE 262 Deleted - Engineering Surveying S | 3.5**

**MINE 267 Applied Chemistry for Mining W | 3.5**

**MINE 268 Analytical Methods in Mining W | 1**

**MINE 307 Front Line Supervision W | 1.5**

**MINE 321 Drilling and Blasting F | 4.5**

**MINE 324 Hydraulics for Mining Applications W | 3.5**

**MINE 326 Operations Research W | 4.5**

**MINE 330 Mineral Industry Economics F | 3.5**

**MINE 331 Methods of Mineral Separation F | 4.5**

**MINE 335 Mineral Processing F | 3**

**MINE 338 Deleted - Mine Ventilation |**

**MINE 339 Mine Ventilation F | 4.5**

**MINE 341 Open Pit Mining F | 4.5**

**MINE 344 Underground Mining W | 3**

**MINE 422 Mining and Sustainability F | 4**

**MINE 434 Project Report F/W | 4**

**MINE 445 Open Pit Mine Design W | 5.5**

**MINE 448 Underground Design W | 5.5**

**MINE 451 Chemical Extraction of Metals F | 3**

**MINE 455 Design, Analysis and Operation of Mineral Processes F | 4.5**

**MINE 458 Process Investigations W | 4**

**MINE 459 Risk and Reliability Analysis for Industrial Asset Management, Health & Safety F | 4**

**MINE 460 Special Topics in Mining Engineering F/W | 4.5**

**MINE 467 Geostatistics and Orebody Modelling F | 4.5**

**MINE 469 Stability Analysis in Mine Design F | 4**

**MINE 471 Mine-Mechanical Design Project W | 5.5**

**MINE 472 Mining Systems, Automation, and Robotics O/L | K3.5**

**MNTC P01 Engineering Mathematics O/L | 3**

**MNTC P02 Mining Geology O/L | 3**

**MNTC P03 Foundational Mathematics O/L | 3**

**MNTC P04 Calculus O/L | 3**

**MNTC P05 Foundational Physics O/L | 3**

**MNTC P06 Foundational Chemistry O/L | 3**

**MNTC P07 Surveying Principles O/L | 3**

**MNTC 301 Technical Writing and Communication O/L | 3**

**MNTC 302 Engineering Physics O/L | 3**

**MNTC 303 Engineering Chemistry O/L | 3**

**MNTC 304 Applied Metrology and Data Analysis O/L | 3**

**MNTC 305 Introduction to Mining O/L | 3**

**MNTC 306 Mineral Processing Unit Operations O/L | 3**

**MNTC 307 Geomechanics and Ground Control O/L | 3**

**MNTC 310 Mining and Society O/L | 3**

**MNTC 311 Ore Body Modelling and Resource Estimation O/L | 3**

**MNTC 313 Introduction to Programming O/L | 3**

**MNTC 314 Drilling and Blasting O/L | 3**

**MNTC 316 Ventilation and Hydraulics O/L | 3**

**MNTC 399 Field School I (on site) S | 5**

**MNTC 408 Mine Health and Safety O/L | 3**

**MNTC 409 Mineral Economics O/L | 3**

**MNTC 413 Surface Mine Planning O/L | 3**

**MNTC 414 Underground Mine Planning O/L | 3**

**MNTC 415 Metal Extraction Processes O/L | 3**

**MNTC 418 Sustainability and the Environment O/L | 3**

**MNTC 419 Mine Supervision and Project Management O/L | 3**

**MNTC 420 Physical Asset Management O/L | 3**

**MNTC 421 DELETED Technology and Innovation O/L | 3**

**MNTC 423 Geomatics O/L | 3**

**MNTC 498 Capstone Project O/L | 3**

**MNTC 499 Field School II (on site) S | 5**

**BIOM 300 NOT OFFERED 2019-2020 - Modeling Techniques in Biology F | 3**

**MTHE 212 Linear Algebra W | 3.5**

**MTHE 217 Algebraic Structures with Applications F | 3.5**

**MTHE 224 Applied Mathematics for Civil Engineers F | 4.2**

**MTHE 225 Ordinary Differential Equations F/W/S-OL | 3.5**

**MTHE 227 Vector Analysis F | 3**

**MTHE 228 Complex Analysis W | 3.5**

**MTHE 232 Deleted - Differential Equations |**

**MTHE 235 Differential Equations for Electrical and Computer Engineers F | 3.5**

**MTHE 237 Differential Equations for Engineering Science F | 3.25**

**MTHE 272 NOT OFFERED 2019-2020 - Application of Numerical Methods W | 3.5**

**MTHE 280 Advanced Calculus F | 3.5**

**MTHE 281 Introduction to Real Analysis W | 3.5**

**MTHE 312 Deleted - Linear Algebra |**

**MTHE 326 Functions of a Complex Variable F | 3.5**

**MTHE 332 Introduction to Control W | 4**

**MTHE 333 Deleted - Control-Robotics Lab I |**

**MTHE 334 Mathematical Methods for Engineering and Physics F | 3.5**

**MTHE 335 Mathematics of Engineering Systems W | 3.5**

**MTHE 337 Introduction to Operations Research Models W | 3**

**MTHE 338 Fourier Methods for Boundary Value Problems F | 3.5**

**MTHE 339 Evolutionary Game Theory F | 3**

**MTHE 351 Probability I F | 3.5**

**MTHE 353 Probability II W | 3**

**MTHE 367 Engineering Data Analysis W | 3.5**

**MTHE 393 Engineering Design and Practice for Mathematics and Engineering W | K4**

**MTHE 406 NOT OFFERED 2019-2020 - Introduction to Coding Theory F | 3**

**MTHE 418 Number Theory and Cryptography F | 3**

**MTHE 430 Modern Control Theory F | 4**

**MTHE 434 NOT OFFERED 2019-2020 - Optimization Theory with Applications to Machine Learning F | 3.5**

**MTHE 437 Topics in Applied Mathematics W | 3**

**MTHE 439 Lagrangian Mechanics, Dynamics, and Control W | 3.5**

**MTHE 454 NOT OFFERED 2019-2020 - Statistical Spectrum Estimation W | 3**

**MTHE 455 Stochastic Processes and Applications F | 3.5**

**MTHE 472 Control of Stochastic Systems W | 3**

**MTHE 474 Information Theory F | 3**

**MTHE 477 Data Compression and Source Coding W | 3**

**MTHE 478 NOT OFFERED 2019-2020 - Topics in Communication Theory F/W | 3**

**MTHE 484 NOT OFFERED 2019-2020 - Data Networks W | 3**

**MTHE 493 Engineering Mathematics Project FW\* | K7.5**

**MTHE 494 Mathematics and Engineering Seminar F | 3**

**SURP 844 Real Estate Planning and Development W | 3**

**SURP 851 Environmental Policy W | 3**

**SURP 853 Environmental Services W | 3**

**SURP 855 Environmental Planning and Management W | 3**

**SURP 874 Housing Policy F | 3**

**ANAT 100 Anatomy of the Human Body F,W,S | 3.0**

**BCHM 310 Deleted-General Biochemistry FW | 9**

**BCHM 410 Deleted-Protein Structure and Function F | 3**

**BIOL 102 Deleted-Introductory Biology of Cells F | 3**

## Admission and Fees

### Admissions

#### Information on Admissions

Students who are considering applying to Queen's are directed to Queen's Admission Services at: <http://www.queensu.ca/admission>. The Admissions website provides information regarding the admission requirements for all undergraduate programs, facilities and services, residences, scholarships and financial assistance.

### Campus Visits

Applicants and potential applicants are encouraged to visit the Queen's campus, as well as the Faculty of Engineering and Applied Science. Formal arrangements can be made by contacting [engineering.reception@queensu.ca](mailto:engineering.reception@queensu.ca).

### Criteria

Admission is offered to the best qualified students applying. Academic success is the primary criterion for admission to Engineering and Applied Science. Students whose academic performance exceeds a required minimum will receive an offer of admission. In all other cases, students will be evaluated on a combination of their academic and non-academic achievements. Submission of a completed Personal Statement of Experience (PSE) form is required for all first year applicants.

### Fees

The Board of Trustees reserves the right to make changes in the scale of fees if, in its opinion, circumstances so warrant.

#### Tuition Fees

Tuition fees are reviewed each year and are dependent on government funding and regulation. Specific information on tuition levels is available on the Web at <http://queensu.ca/registrar/financials/tuition-fees>. Students are encouraged to become familiar with this information.

#### Ancillary Fees

Students may be required to pay ancillary fees for course related learning materials, safety equipment and field trips. The maximum estimated compulsory fees for specific academic plans are shown below. Those plans not listed do not have ancillary fees. In most cases the actual cost to individual students will be less than the amount indicated.

First Year	\$	109
Geological Engineering <sup>1</sup>		2,825
Mechanical Engineering <sup>2</sup>		100

Mining Engineering <sup>3</sup>		250
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<sup>1</sup>See the Geological Engineering Academic Plan section of this calendar for a breakdown and explanation of costs.

<sup>2</sup>Fee for MECH 370 optional field trip.

<sup>3</sup>To be confirmed prior to start of the Fall term.

## Non-compulsory Fees

Academic Appeal Fee will be refunded if appeal is granted.	\$40.00	Payable through Student Services. See <a href="http://engineering.queensu.ca/Current-Students/Registration-Guide/Academic-Regulation-Requests-Waivers-and-Appeals.html">http://engineering.queensu.ca/Current-Students/Registration-Guide/Academic-Regulation-Requests-Waivers-and-Appeals.html</a> for official form and payment information.
Request for Course Substitution (Letter of Permission) To take a course from another university and substitute the course for credit towards Queen's Engineering Degree.	60.00	Payable through Student Services. See <a href="http://engineering.queensu.ca/Current-Students/Registration-Guide/Academic-Regulation-Requests-Waivers-and-Appeals.html">http://engineering.queensu.ca/Current-Students/Registration-Guide/Academic-Regulation-Requests-Waivers-and-Appeals.html</a> for official form and payment information.
Course Description Request	60.00/hr	Payable through Student Services. Contact <a href="mailto:engineering.reception@queensu.ca">engineering.reception@queensu.ca</a> to make request and discuss payment.
Document Fee For completion of all documents related to registration at Queen's. Includes documents such as proof of enrolment, degree eligibility.	30.00	Payable through Student Services. Contact <a href="mailto:engineering.reception@queensu.ca">engineering.reception@queensu.ca</a> to make request and discuss payment.
Exchange Program Fee	125.00	Payable through Student Services. Contact the International Student Advisor at <a href="mailto:engineering.intladvisor@queensu.ca">engineering.intladvisor@queensu.ca</a> for more information.
Exam Rereads Fee will be refunded if the mark increases.	50.00	Payable through Student Services. See <a href="http://engineering.queensu.ca/Current-Students/Registration-Guide/Academic-Regulation-Requests-Waivers-and-Appeals.html">http://engineering.queensu.ca/Current-Students/Registration-Guide/Academic-Regulation-Requests-Waivers-and-Appeals.html</a> for official form and payment information.
Internship Program - application fee	35.00	Please contact Micheline Johnston at <a href="mailto:micheline.johnston@queensu.ca">micheline.johnston@queensu.ca</a> for application and payment information.
Late Application Fee includes late course add/drop, late registration/withdrawal of Supplemental Examinations of J	60.00	Payable through Student Services. See <a href="http://engineering.queensu.ca/Current-Students/Registration-Guide/Academic-Regulation-Requests-Waivers-and-Appeals.html">http://engineering.queensu.ca/Current-Students/Registration-Guide/Academic-Regulation-Requests-Waivers-and-Appeals.html</a> for official form and payment information.

Section Re-write Exams, late Application to Graduate		
Readmission Application Fee	55.00	Payable through Student Services. Contact the Assistant to the Associate Dean (Academic) <a href="mailto:eng.deanacad.admin@queensu.ca">eng.deanacad.admin@queensu.ca</a> if you have any questions.
Registered Education Savings Plan - form completion Fee includes direct submission of RESP form by registered mail or fax.	30.00	Payable through Student Services. Contact <a href="mailto:engineering.reception@queensu.ca">engineering.reception@queensu.ca</a> to make request and discuss payment.
Required to Withdraw Waiver Request	40.00	Payable through Student Services. See <a href="http://engineering.queensu.ca/Current-Students/Registration-Guide/Academic-Regulation-Requests-Waivers-and-Appeals.html">http://engineering.queensu.ca/Current-Students/Registration-Guide/Academic-Regulation-Requests-Waivers-and-Appeals.html</a> for official form and payment information.
Supplemental Examinations	300.00	Payable through SOLUS
<b>Extended Program (Section 900/J-Section) &amp; Rewrite Exams:</b>		
Extended Program - Section 900 per course tuition fee <sup>1</sup>	539.63	Payable through SOLUS
Rewrite Exam - per exam fee (Spring term) <sup>2</sup>	300.00 +SAL	Payable through SOLUS
Section 900 or Rewrite Exam - remote exam fee per exam <sup>3</sup>	300.00	Payable through Student Services. Please see <a href="http://engineering.queensu.ca/Current-Students/First-Year-Studies/Section900/DetailedInformation.html#Rewrite">http://engineering.queensu.ca/Current-Students/First-Year-Studies/Section900/DetailedInformation.html#Rewrite</a> for more information.
Section 900 or Rewrite Exam - remote exam admin fee <sup>3</sup>	75.00	Payable through Student Services. Please see <a href="http://engineering.queensu.ca/Current-Students/First-Year-Studies/Section900/DetailedInformation.html#Rewrite">http://engineering.queensu.ca/Current-Students/First-Year-Studies/Section900/DetailedInformation.html#Rewrite</a> for more information.

<sup>1</sup>The course tuition fee is for the 6-week portion of the course that extends past the end of Winter term, and includes Spring term exams in June.

<sup>2</sup>The Spring exam fees are assessed under the current fee schedule and will be \$470.00, plus \$10.00. (SAL = Student Assistance Levy) per exam.

<sup>3</sup>Students may choose to write exams in a location other than Kingston. There is a \$300 fee per exam plus an administrative fee of \$75.00 for one or more exams.



Fees quoted are for domestic students. Fees for International students are higher. Please contact the Registrar's Office or refer to the Guide to Registration and Fees at <http://www.queensu.ca/registrar/> for details. In case of differences between the above and the Guide, the fees shown in the Guide shall prevail.

## **Account Information**

Students can use SOLUS to determine their account balances.

## **Student Services Fee Payments**

We do not accept cash payments at any time. Credit card payments may be made in the Faculty of Engineering and Applied Science Online Store <https://store.engineering.queensu.ca/>.

No form that requires a Student Services payable fee will be processed without payment.

Cheques are to be made out to "Queen's University".

PLEASE DO NOT PROVIDE CREDIT CARD NUMBERS AT ANYTIME, VIA EMAIL.

## **Debts**

Any student with an overdue debt with the University will not be permitted to register or to receive examination results, official transcripts, or marks reports until the outstanding account is settled in full. A Senate Regulation forbids the release of a diploma to a student in debt to the University.

## **Questions**

Questions about fees or charges should be directed to:

Office of the University Registrar  
Gordon Hall  
Queen's University  
Kingston, Ontario  
K7L 3N6  
Telephone: 613 533-6894

Please refer to the *Guide to Registration and Fees* (<http://www.queensu.ca/registrar>) for a comprehensive outline of the items referred to above.

## **Faculty Policies and Regulations**

The Faculty of Engineering and Applied Science may be obliged to make changes to the curricula, academic plan descriptions, and course descriptions in this Calendar.

In that case, the corrections will appear in the Minutes of the Faculty Board. In the event of discrepancies between statements that appear on the Faculty Web Sites and the corresponding statements in this Calendar and the Faculty Board Minutes, the latter versions will apply. The following policies and regulations apply to all students registered in the Faculty of Engineering and Applied Science.

The Faculty intends its students to have as much opportunity as possible to develop their individual interests and abilities. Its regulations, academic plans and fields of study have been developed with this goal in mind. The plans, curricula and courses of study are, however, constrained by many factors including accreditation requirements,

timetabling, physical facilities, number of staff and the interests of faculty members. The current offerings have been designed in the light of experience and of these restrictions to provide a sufficiently diverse selection to satisfy the interests of most students. However, some students may have valid reasons for seeking variations from the prescribed programs and the regulations include provision for doing so (see Regulations 2d and 2e).

## **Faculty Policies**

All FEAS Policies conform with Senate policies. All Faculty Regulations are approved by Senate. Senate Policies of particular relevance to students in Engineering and Applied Science are outlined below. The relevant links are provided through the Calendar website under "Senate Policies".

Access and Privacy

Student Appeals, Rights and Discipline

Policy on Academic Integrity

Student Access to Final Examination Papers

Confidential Exams

Electronic Information Security Policy Framework

## **Academic Integrity Policy Statement**

Queen's University is dedicated to creating a scholarly community free to explore a range of ideas, to build and advance knowledge, and to share the ideas and knowledge that emerge from a range of intellectual pursuits. Queen's students, faculty, administrators and staff therefore all have responsibilities for supporting and upholding the fundamental values of academic integrity. Academic integrity is constituted by the five core fundamental values of honesty, trust, fairness, respect and responsibility (see <http://www.academicintegrity.org/ica/home.php>) and by the quality of courage. These values and qualities are central to the building, nurturing and sustaining of an academic community in which all members of the community will thrive. Adherence to the values expressed through academic integrity forms a foundation for the "freedom of inquiry and exchange of ideas" essential to the intellectual life of the University.

Honesty in a University is an essential component in maintaining high ethical standards. In preparing students for the profession of engineering, the Faculty of Engineering and Applied Science must send a clear message that high standards are expected. Consistent with this message, students are entitled to an environment where individual performance can be presented and evaluated as fairly as possible. Courses and assignments vary in the amount of collaborative versus individual work that is expected, and the intention of the instructor must be clear to the student. Similarly, the physical setting for examinations should allow individual work where invigilation need not be intrusive. The type and amount of any information that a student may take into an examination must be clearly known ahead of time and of a nature that can be easily verified.

The detailed Policies and Procedures for Departure from Academic Integrity (DFAI) are on-line at:  
<http://engineering.queensu.ca/policy/Honesty.html>

## **Faculty Regulations**

### **1. Registration**

- a. A student must register in courses within the first two weeks of the commencement of term.

- b. The addition of a course after the prescribed "add course" deadline requires approval of the course instructor, the department in which the student is registered, and the FEAS Faculty Board Committee.
- c. A student must withdraw from courses within the first two weeks of the commencement of term to avoid financial penalty.
- d. A student may withdraw voluntarily from a Fall Term course or a Winter term course prior to the deadline to drop without academic penalty. If so dropped, the course is removed from student record.
- e. Withdrawal from a course after the prescribed deadline to drop without academic penalty requires the approval of the Undergraduate Chair and the FEAS Faculty Board Committee, and will only be permitted in exceptional circumstances that would prevent the student from dropping the course within the prescribed deadline. Withdrawals such as these will be indicated on the student's transcript by the designation DR (see Regulation 3h).
- f. A student may apply for a change from one FEAS academic plan to another by July 31st for the Fall term and by December 1st for the Winter term. Late requests will be considered until August 15th for Fall term and December 15th for Winter term and will be subject to late application fees. Requests are submitted for the approval of the Associate Dean (Academic).
- g. Students must obtain approval from Student Services, FEAS, to add or drop first year courses.
- h. A student may add an Extended Program offering of a Fall Term course, or apply to rewrite a Fall Term examination, only within the first three weeks after the commencement of Winter Term and may drop such a course only within the first four weeks after the commencement of Winter Term. A student may add an Extended Program offering of a Winter Term course only within the first nine weeks after the commencement of Winter Term and may drop such a course only before the end of regular Winter Term classes.
- i. A student who wishes to rewrite second term examinations of the first year when they are offered at the end of the Extended Program may register to do so only within the first two weeks of the Summer Term, and may cancel this registration without academic penalty only within the first three weeks of the Summer Term.

## 2. Programs of Study

- a. Students are responsible for ensuring that their course registrations are accurate and complete, and that the courses in which they register meet the requirements for graduation. Course prerequisites and any restrictions on enrolment should be noted carefully prior to registration. The Undergraduate Chair for the academic plan, or the year advisors in the department, should be consulted whenever requirements are not fully understood.
- b. A student who is registered in the Regular First Year Program for Winter Term courses may register to rewrite the final examination in any failed first year course at the next examination period only if the student's term Grade Point Average (GPA) is 0.7 or higher in both Fall and Winter terms
- c. An upper year student may request an exemption in a course by application to the FEAS Faculty Board Committee or delegate on the basis of knowledge acquired through practical experience or acquired through studies prior to first admission to the FEAS. Approval for a request for a course exemption must be recommended by the course instructor and by the Department, on the basis of a satisfactory assessment of the student's proficiency in the exempted course material. In cases where the student's total units fall below the minimum CEAB requirement, a replacement course of total weight, and CEAB units must be proposed in the exemption application. If the exemption is granted the student must take and pass the specified replacement course.
- d. An upper year student may request permission for substitution of a course in their program by a similar course, either at Queen's or elsewhere, by application to the FEAS Faculty Board Committee. This request must be submitted prior to completing the substitute course. Approval for a request for a course substitution must be recommended by the instructor of the prescribed course and the Department. For courses other than Complementary Studies, the request will normally only be considered if the institution offering the course has an accredited engineering program and if the student has an Engineering Cumulative Grade Point Average (ECGPA) of at least 1.6. If a request

to take a substitute course at another institution is approved, the FEAS will issue a Letter of Permission to allow the student to enroll in the course.

- e. A student seeking a degree in FEAS may not receive more than two years of credits for work done in another Faculty or university, and such credits may not encompass more than one half of the courses of the third and fourth years of the program. Additionally, at least one half of the fourth year of the program must be taken at Queen's.
- f. Free discipline choice of academic plan (discipline) is only guaranteed during the winter term selection period, and only for students who have passed all their first year courses. In exceptional circumstances (i.e., academic difficulty, please refer to Regulation 10) a student may not be permitted to choose a discipline, and may instead be required to repeat first year
- g. A student who has not passed all of the courses of the first year which are specified as prerequisite to any course in the chosen upper year program must, during the next session, follow a special Fall and Winter term program arranged by the Undergraduate Chair of the chosen program. During this session, the student must pass all prerequisite courses during the session or they will be required to withdraw.

### 3. Course Weighting

- a. Each course in the Calendar of the Faculty of Engineering and Applied Science is assigned a weight as specified in the Calendar. A weight of 1 unit is given for each 12 lecture hours in a course, with 0.5 units given for every 12 tutorial hours, and 0.5 units for every 12 lab hours. The multiplying factor to convert from "units" to CEAB accreditation units (AUs) is thus equal to the number of weeks in a term, i.e. 1 unit = 12 AUs for a 12-week course. When engineering students take courses outside the FEAS they must use the unit weighting assigned by the Faculty hosting the course.
- b. The following table indicates the grading system used in the FEAS, including permitted letter grades, associated grade points, and equivalent percentage marks. If percentage marks are submitted by instructors, these will be converted to letter grades and grade points and will not be used in the evaluation of student progress or academic standing.

Letter Grade	Grade Points	Numeric Equivalent
A+	4.3	90-100%
A	4.0	85-89%
A-	3.7	80-84%
B+	3.3	77-79%
B	3.0	73-76%
B-	2.7	70-72%
C+	2.3	67-69%
C	2.0	63-66%
C-	1.7	60-62%

D+	1.3	57-59%
D	1.0	53-56%
D-	0.7	50-52%
FR	0.0	40-49%
F	0.0	0-39%

- c. The Grade Point Averages (GPAs) used in determining a student's standing are calculated by multiplying the grade points earned in a course by the unit value of that course, summing the products so obtained for all the courses in a given period, and dividing this sum by the total number of units attempted during that given period of time over which the GPA is calculated. Each course is only counted once in calculating either the ECGPA or term GPA. When, during the period considered, a course or a course examination is repeated or replaced by a substitution approved by the FEAS Faculty Board Committee, only the most recently obtained mark will be used in calculating the GPA. Changes to the GPA after the assessment period in May will not impact student assessment decisions.
- d. The "Academic Year" concludes at the end of winter term, and includes the previous three consecutive terms (summer, fall, winter). The Engineering term GPA is the Grade Point Average of all Queen's courses taken in an Engineering term in an academic year, while the student is registered in the FEAS. Decisions regarding yearly academic progress will be based on term GPA.
- e. The Engineering Cumulative Grade Point Average (ECGPA) is the Grade Point Average of all courses taken in the Summer, Fall and Winter terms of all academic years, while the student is registered in the FEAS. Queen's courses taken during the summer term of the academic year will also be included in the ECGPA.
- f. For Classes 2022 and earlier only: The Engineering Graduation Grade Point Average (EGGPA) is calculated after all academic plan requirements have been met and follows the same calculation method as the ECGPA, except that it excludes courses that are part of the First Year Curriculum.
- g. Academic status of each student is assessed once a year, at the end of the Winter term. Decisions regarding yearly academic progress will be based on the Fall and Winter term GPA and the ECGPA.
- h. Non-evaluative grades: The following is a list of the possible non-evaluative grades and their uses.

**Incomplete (IN):**

Incomplete standing (IN) is a temporary designation normally reserved for cases where students, because of extenuating circumstances beyond their control, have successfully completed the majority of the graded work, but not all course work (which may include, but is not limited to, assignments, projects, quizzes, mid-terms, and final exams). All Incomplete designations require appropriate supporting documentation, and must be approved by the FEAS Faculty Board Committee. Approval of the instructor must be obtained, and a date will be set for the completion of the work (normally within 9 months of approval). An IN designation will revert to the "default grade" submitted by the instructor after the date set for completion of the work. Please see Regulation 4b for further information.

**Pass in a Pass/Fail Course (P)**

Some courses do not apply letter grades. The outcome is Pass (P) or Fail (F) to reflect whether the student has successfully fulfilled all the requirements. A course that has been designated as Pass/Fail will not be included

in the student's GPA but can be counted as credit towards an academic plan.

**Dropped (DR)**

The Dropped (DR) designation indicates a course that has been dropped after the deadline to drop without academic penalty. This designation can only be applied with approval from the FEAS Faculty Board Committee. For information, please see Regulation 1e.

**Failure with Review (FR)**

For information, please see Regulation 14 - Supplemental Examinations

**Grade Deferred (GD)**

The Grade Deferred (GD) designation is a temporary designation used in situations where a student's final grade in a course is being held.

**Audit (AU)**

The AU designation indicates that a course has been Audited. For information, please see Regulation 16b.

**4. Standing in a Course**

- a. The passing grade for a course is D- or above, or P. The basis upon which the final grade is assigned, including the weight given to course work, should be made available to students by the instructor via the course syllabus at the beginning of a course.
- b. If a student is unable to write the final examination or to submit required coursework because of incapacitating illness or other extenuating circumstances, a temporary designation of IN (incomplete) will be recorded for the course on the recommendation of the course instructor, the Undergraduate Chair, and upon approval by the FEAS Faculty Board Committee (see regulation 3h). The submission of a mark of IN must be accompanied by appropriate supporting documentation, and by a proposed date of completion, but no later than 9 months beyond the date of approval. The course for which a mark of IN has been entered will be excluded when calculating the term GPA and Cumulative GPA of the student concerned. An IN on a transcript does not preclude the application of Regulations 2g or 10. An IN designation will revert to the "default grade" submitted by the instructor after the date set for completion of the work.

**5. Conduct and Attendance**

- a. A student may, for any form of departure from Academic Integrity, or misconduct in an academic setting, incur penalties up to and including the requirement to withdraw under Regulation 11.
- b. A student who claims illness, compassionate grounds, or other extenuating circumstances, as a reason for missing any required component of the course other than the final exam is responsible to notify the instructors concerned, and make alternative arrangements. If there is a significant effect on attendance or academic performance such that the student may wish to request an incomplete (IN) grade, a course drop or a late course drop the student is responsible for providing appropriate supporting documentation to the FEAS Faculty Board Committee. Students are encouraged to seek academic advice from a program or faculty advisor to obtain guidance on the appropriate action, and the relevant documentation requirements. Refer to Academic Regulation 4b for procedures and documentation required to request an incomplete grade.

**6. Examinations**

- a. Students are referred to the Exam Regulations located on the website of the University Registrar.

**7. Requirements for Graduation\***

To qualify for the degree of Bachelor of Applied Science (B.A.Sc.) in engineering, in the FEAS, a student must, at the end of not more than six active (but not necessarily consecutive) calendar years from date of first registration in the Faculty:

- a. have passed all the courses required in the First Year program;
- b. have passed all courses required by the academic plan in which they registered;

- c. while registered in their engineering program, have passed courses whose units total is not less than the minimum required by the program in which they are registered and each course may be counted only once;
- d. have achieved an ECGPA of 1.6 or higher;
- e. have successfully completed field and technical excursions required by the department in which he or she is registered;
- f. have passed the English Proficiency Test (for Classes 2022 and earlier). Note: students who have not passed the English Proficiency Test as of Fall 2019 will be required to take APSC 199 (English Proficiency for Engineers).
- g. have satisfied the minimum curriculum content specified by the CEAB in each content category;

A student who has not completed the degree program in six years will normally be required to withdraw. An extension will normally be granted to students who have completed, or are working on an Internship, Exchange, or are enrolled in a Dual Degree program, or have received accommodation through the Queen's Accessibility Services, or through academic advising. If a student is allowed to continue, on successful appeal of this regulation, their program of study will be reviewed by the Department and the Faculty. As a result of the review, possible changes to the student's required program will include but not be limited to the following:

- Courses which have changed significantly in content may have to be retaken.
- Additional courses which have been added to the degree program may be required for graduation.
- Courses which are no longer part of the degree program may not count toward the degree.

#### 8. **Scholarship**

- a. To be eligible for scholarship awards, a student must take in one session all the courses, including electives, prescribed for the year of the program in which they are registered. An exception will be made if any of these courses have been completed previously with a grade of C- or higher. In that event other courses of equivalent total weight and approved by FEAS Faculty Board Committee for scholarship purposes must be added to the student's program. Substitutions granted under Regulation 2e are also acceptable.
- b. To be eligible for the Dean's Scholars list, a student must achieve a combined term GPA of 3.5 or higher while taking 16.1 units or higher per term. If granted, a Dean Scholars ruling will be added to the student's academic transcript.

#### 9. **Graduation with Honours Standing**

A student will be granted the status of graduation "with Second Class Honours" if, upon graduation, they have attained either an ECGPA of 2.2 or higher. A student will be granted the status of graduation "with First Class Honours" if, upon graduation, they have attained an ECGPA of 3.5 or more.

#### 10. **Academic Probation and Requirement to Withdraw\***

##### **Academic Probation**

- a. Students shall be placed on Academic Probation, at the time of their academic standing assessment, if they:
  - i. Have an ECGPA between 0.7 and 1.59.
  - ii. Have obtained a term GPA below 1.6 in both the Fall and Winter term.
  - iii. Have a term GPA below 0.7 after the Fall or Winter term may, at the Associate Dean (Academic)'s discretion, be placed on academic probation for the following term, and will be reassessed at the end of that term.
  - iv. Returns to studies after having previously been Required to Withdraw.
  - v. Return to studies after a voluntarily deferral (see reg. 11) may also be placed on probation at the discretion of the Associate Dean (Academic) and the student's department.

In all above cases the academic standing "Placed on Academic Probation" shall be placed on the student's transcript.

- b. A student under Academic Probation must follow a special program for the next Engineering Session:
  - i. Students placed on academic probation under Regulation 10a must repeat courses specified by the Associate Dean, in consultation with the Undergraduate Chair for the academic plan in which the student is registered.
  - ii. The Associate Dean, in consultation with the Undergraduate Chair for the academic plan in which the student is registered, may also specify additional probationary conditions to improve the chances of student success in their program. The total course load for this session must not exceed the AUs prescribed for that year of the program.
- c. Any student who is placed on Academic Probation and who fulfills all of their Academic Probation conditions at the time of their next academic standing assessment shall be released from Academic Probation and will be considered in 'good academic standing'.
- d. Students on Academic Probation will only be considered for release from probation if they have taken a minimum of 12 units since their previous assessment.

**Requirement to Withdraw, with opportunity to be considered for readmission after one year:**

- e. A student whose ECGPA is less than 0.7 at the time of the academic standing assessment has failed the year and is required to withdraw for a period of at least one year, and may be considered for readmission only after one year.
- f. A student whose term GPA is less than 0.7 in both Fall and Winter term or for one term (for students who have completed only one Fall or Winter term) at the time of academic standing assessment has failed the year and is required to withdraw for a period of at least one year, and may be considered for readmission only after one year.
- g. Students who are on Academic Probation under Regulation 10a at the time of assessment and do not fulfill all of their conditions of Academic Probation are required to withdraw for a period of at least one year and may be considered for readmission only after one year.

The academic standing "Required to Withdraw for a minimum of one year" shall be placed on the student's transcript.

**Requirement to Withdraw, with opportunity to be considered for readmission after a minimum of three years:**

- h. A student who has failed a previous year (as per reg. 10e and f), or who has been previously Required to Withdraw for academic reasons (except for Regulation 2g), and whose term GPA is less than 0.7 in both Fall and Winter term has failed the year and is Required to Withdraw for a minimum period of three years. Students under this regulation who have completed only one Fall or Winter term at the time of assessment, will be assessed based on the results of that term.
- i. Students who are on Academic Probation at the time of assessment, do not fulfill all of their conditions of Academic Probation and have previously been required to withdraw, (except for Regulation 2g) are required to withdraw for a minimum period of three years, and may be considered for readmission only after a minimum of three years.

The academic standing "Required to Withdraw for a minimum of three years" shall be placed on the student's transcript.

- j. If a student is Required to Withdraw at the time of their academic standing assessment but is currently taking a Spring/Summer course at Queen's University, they may complete the term-length course in which they are enrolled, but will then be required to withdraw at the end of the term

**11. Withdrawal**

- a. A student experiencing academic difficulty (refer to Regulation 10) may request a deferral of their studies no later than 31 January. The student must apply for a resumption of studies to the FEAS. Students returning to studies after a deferral will be placed on academic probation for their returning year.



- b. The Faculty Board may, at any time, require a student whose conduct, attendance, or work is deemed unsatisfactory, to withdraw or may recommend to Senate a student's dismissal. The student must reapply in order to be considered for readmission to the FEAS.
- c. A student who defers their program for any reason, or is not registered in the FEAS for twelve consecutive months, must reapply in order to be considered for readmission/resumption of studies.

**12. Readmission**

- a. A student applying for readmission after a failed year must present evidence that they are likely to succeed in completing the degree in the program for which readmission is sought. The student shall not be readmitted unless the Associate Dean (Academic) is satisfied that this evidence, together with the student's academic record at Queen's, indicates probable success in completing the degree, and that space is available in the required program. A failed year or a withdrawal from a program in engineering at another university will be treated as if it had occurred at Queen's University.
- b. A student readmitted to the program may, at the discretion of the Associate Dean (Academic) and the student's Undergraduate Chair, be placed on Academic Probation and subsequently must follow a program constrained by the appropriate requirements outlined under Regulation 10b. In addition, during the first year of registration following a failed year the total unit weight of courses in the student's program shall not exceed that of the regular program of the failed year. As outlined in Regulation 10f and 10h, students placed on probation after a failed year or following readmission must fulfill all of their conditions of Academic Probation or be required to withdraw.

**13. Review and Rereading of Examination Papers**

Students have the right of access to their final examination papers. As a first step, the student should request an informal review with the instructor concerned, and instructors are strongly encouraged to consent. If the request for an informal review is denied or if the student is not satisfied with the decision, the student may submit a formal exam re-read request to the FEAS. The exam re-read request must be submitted in writing to the FEAS within four weeks of the release of results. The application is to be accompanied by the rereading fee.

(The attention of students is directed to the Senate Policy on Student Access to Final Examinations and to Regulation 14b regarding the deadline for applying to write a supplemental examination).

**14. Supplemental Examinations\***

- a. A student receiving a grade of FR (Failure with Review) may be permitted, upon formal request to the FEAS, to write a supplemental examination in a failed upper year course offered in the FEAS provided the student has an ECGPA of 1.6 or higher and has obtained a term GPA of 0.7 or higher in the previous Fall and Winter terms. Supplemental examinations will be held at Queen's University in September, typically during orientation week. The privilege of writing these supplemental examinations will be confined to this September week following the session in which the failure occurred, and limited to a maximum of three examinations in the student's academic plan, with no more than two in any calendar year. Supplemental examinations cannot be rescheduled, and there are no provisions for make-ups of the supplemental examinations.
- b. A student requesting permission to write a supplemental examination must apply in writing to the FEAS by the specified deadline following the session in which the failure occurred. A student may cancel a request for a supplemental examination and the examination fee will be refunded if written notice of the cancellation is received by the FEAS by the specified deadline following the session in which the failure occurred.
- c. The result obtained on a supplemental examination will be substituted for that of the previous final examination in producing the final grade for the course. A student failing to write a supplemental examination for which they are registered and who has not canceled their registration by the specified date will be assigned a final grade of F on the supplemental examination. The final grade for a course which is based on a supplemental examination will be included in the ECGPA for the next Engineering Session. Supplemental marks will not impact or change any previous student assessment decisions.

**15. Written English Proficiency (Classes 2022 and earlier only)**

- a. A student must, within the first academic term of first registration, take a written English Proficiency Test as specified for students registered in the FEAS.
- b. Upon successful completion of the English Proficiency Test, the designation "English Proficiency Test Passed" will be added to the student transcript.
- c. A student must pass the English Proficiency Test or an equivalent test, approved by the Associate Dean (Academic), to be eligible for graduation.

#### 16. **Special Students**

- a. Students may be allowed to take courses in the FEAS without being registered in an academic plan. Such students are defined as "Special Students" and must apply to the Faculty before taking any courses. A Special Student may apply for admission as a regular student proceeding to a degree but, once admitted as a regular student, a student may not re-register as a Special Student before completing a degree in the FEAS.
- b. Students interested in auditing an Undergraduate FEAS course must apply to the Faculty, and approval is given on a case by case basis and only when there is space in the course (refer to reg. 3h).

\* *NOTE:* The following regulations do not apply to Bachelor of Mining Engineering Technology (BTech) Regulation 1b, Regulation 1f, Regulation 1g, Regulation 2g, Regulation 3a, Regulation 3d, Regulation 3e, Regulation 7, Regulation 10, Regulation 14

#### 17. **Regulations Specific to the Bachelor of Mining Engineering Technology program**

Students enrolled in the Bachelor of Mining Engineering Technology ("BTech") program have specific Bridge Course requirements, as well as specific regulations relating to Requirements for Graduation (replacing Regulation 7), and Academic Probation and Requirements to Withdraw (replacing Regulation 10). The following Regulations apply to BTech students:

##### a. **Bridge Course Requirements - BTech (MINE)**

Upon admission to the BTech program, each student will be enrolled in specific, required, Bridge courses based on their previous academic history. The required Bridge courses for each student may be different, and will be determined by the Associate Dean (Academic) in consultation with the Program Chair for the BTech (MINE) program. In order to be admitted into the Year 3 of the BTech (MINE) program, a student must pass each required Bridge course with a minimum grade of C-.

##### b. **Requirements for Graduation - BTech (MINE)**

To qualify for the degree of Bachelor of Mining Engineering Technology in the FEAS, a student must, at the end of not more than ten calendar years from date of first registration in the Faculty:

- i. Have passed all courses required by the BTech (MINE) program
- ii. Have achieved an Engineering Cumulative Grade Point Average (ECGPA) of 1.3 or higher
- iii. Have successfully completed field and technical excursions required by the BTech Program.
- iv. Have passed the English Proficiency Test. Note: students who have not passed the English Proficiency Test as of Fall 2019 will be required to take APSC 199 (English Proficiency for Engineers).

A student who has not completed the degree program within ten years of first registering will normally be required to withdraw. An extension will normally be granted to students who have received accommodation that requires a lighter course load through the Queen's Accessibility Services, or through academic advising. If a student is allowed to continue, on successful appeal of this regulation, his/her program of study will be reviewed by the BTech (MINE) Undergraduate Chair and the Faculty. As a result of the review, possible changes to the student's required program will include but not be limited to the following:

- Courses which are no longer part of the academic plan may not count toward the degree.
- Additional courses which have been added to the degree program may be required for graduation.
- Courses which have changed significantly in content may have to be retaken.

**c. Academic Probation and Requirement to Withdraw - BTech (MINE)**

**Academic Probation**

- i. A student shall be placed on Academic Probation, at the time of their academic standing assessment, if they:
  - (1) have an ECGPA of less than 1.3. NOTE: the ECGPA excludes final grades received in Bridge courses.
  - (2) return to studies after having previously been Required to Withdraw.

The academic standing "Placed on Academic Probation" shall be placed on the student's transcript.

- ii. A student under Academic Probation must follow a special program for the next Engineering Session:
  - (1) Students with an ECGPA less than 1.3, or students returning to studies after being previously Required to Withdraw, must repeat courses specified by the Associate Dean, in consultation with the BTech (MINE) program chair.
  - (2) The Associate Dean (Academic), in consultation with the BTech (MINE) program chair, may also specify additional probationary conditions to improve the chances of student success. The total course load for the probationary session must not exceed the maximum number of units prescribed for that year of the program.
- iii. Any student who is placed on Academic Probation and who fulfills all of their Academic Probation conditions at the time of their next academic standing assessment shall be released from Academic Probation.
- iv. If a student is Required to Withdraw at the time of their academic standing assessment but is currently taking a Spring/Summer course at Queen's University, they may complete the term-length course in which they are enrolled, but is then required to withdraw at the end of the term.

**Requirement to Withdraw, with opportunity to be considered for readmission after one year:**

- v. A student whose ECGPA is less than 0.7 at the time of the academic standing assessment has failed the year and is required to withdraw for a period of at least one year, and may be considered for readmission only after one year.
- vi. A student who is on Academic Probation under Regulation 18.d (i) at the time of assessment and does not fulfill all of their conditions of Academic Probation is required to withdraw for a period of at least one year and may be considered for readmission only after one year. The academic standing "Required to Withdraw for a minimum of one year" shall be placed on the student's transcript.

**Requirement to Withdraw, with opportunity to be considered for readmission after a minimum of three years:**

- vii. A student who has failed a previous year, or who has been previously Required to Withdraw for academic reasons, and whose ECGPA at the time of their academic standing assessment is less than 0.7 has failed the year and is required to withdraw for a minimum period of three years, and may be considered for readmission only after a minimum of three years.
- viii. A student who is on Academic Probation at the time of assessment, does not fulfill all of their conditions of Academic Probation and has previously been required to withdraw, is required to withdraw for a minimum period of three years, and may be considered for readmission only after a minimum of three years. The academic standing "Required to Withdraw for a minimum of three years" shall be placed on the student's transcript.

**18. Regulations specific to the B.A.Sc. with Professional Internship**

Students in second or third year of any Engineering program may enroll in a five-year "Bachelor of Applied Science in Engineering Degree program with Professional Internship."

Students who complete successfully the requirements of the Professional Internship program, upon graduating, will receive the designation "B.A.Sc. with Professional Internship" on their transcript.

The requirements of the Professional Internship program are:

- a. Students must register in the Queen's University Internship Program and will be enrolled in specific, required Academic Internship courses, depending upon the duration and timing of their internship.
- b. To receive a Professional Internship, students must spend a minimum of 12 months, and a maximum of 16 months on Internship.
- c. Students must fulfill the requirements stipulated by their Employment contract, as well as the requirements stipulated by their Academic Internship courses, listed in the FEAS Calendar.
- d. A student must be in good academic standing (see Regulation 10) to undertake an Internship. The minimum ECGPA requirement at the time of application is 1.9, and a minimum term GPA of 2.0 in the last active term (excluding Summer term).
- e. Undertaking a Professional Internship does not affect in any other way the current academic program of the student – all standard faculty policies apply, with the understanding that students take a minimum of 12 months, and a maximum of 16 months out of their regular academic programs to pursue Professional Internship.

## **Senate Policies**

From time to time, the Senate of the University adopts policies governing administrative and academic affairs of all members of the University Community, including Undergraduate Students in the Faculty of Engineering and Applied Science. These policies can be found on Senate Websites. The most convenient entry to these is the index can be found at Senate and University-wide policies.

Faculty Regulations must conform with Senate policies. All Faculty Regulations are approved by Senate. Digests of some of the Senate Policies of particular relevance to students in Engineering and Applied Science are given here. The date after the title is the year in which the policy was adopted or most recently amended.

Access and Privacy  
Student Appeals, Rights and Discipline (2004)  
Policy on Academic Integrity  
Student Access to Final Examination Papers  
Confidential Exams  
Electronic Information Security Policy Framework

## **Awards and Financial Assistance**

### **Prospective Students**

Please visit the Awards website.

### **Student Financial Assistance**

Student Awards, as part of the Office of the University Registrar, plays a key role in supporting the University's mission. Our goal is to ensure that all students have the opportunity to attend Queen's, regardless of their personal financial circumstances. To achieve this, a variety of funding sources may be required.

The Student Awards Office is responsible for administering all merit-based undergraduate funding and all need-based funding for both undergraduate and graduate students. Merit-based (scholarship) funding recognizes and rewards students for their achievement, both academic and extra-curricular. Need-based funding (bursaries, awards, work study, loans and grants) is disbursed to students on the basis of demonstrated financial need. Listed directly below is general information as it pertains to the various student financial assistance programs administered by the Student Awards Office. For more detailed information please refer to either the Student Awards website or contact the office.

Awards Officers are available throughout the year to provide financial advising on budgeting and the various options available to assist students with financing their Queen's education.

For further information:

Office of the University Registrar  
Student Awards  
Gordon Hall, 74 Union Street  
Queen's University  
Kingston, Ontario, Canada K7L 3N6  
Tel: 613-533-2216  
Fax: 613-533-6409  
E-mail: [awards@queensu.ca](mailto:awards@queensu.ca)  
Web: <http://www.queensu.ca/studentawards/>

## **Government Student Financial Assistance (Loans and Grants)**

The federal and provincial governments provide student financial assistance for Canadian citizens, permanent residents, and protected persons studying at the post-secondary level. This assistance is intended to supplement student and family resources and recipients must demonstrate financial need. This assistance is offered in the form of repayable loans and in some cases may also include a limited amount of grant or bursary funding.

The appropriate provincial or territorial authorities will evaluate student applications and will provide funding. Funding options, eligibility criteria and regulations vary by jurisdiction. Students from Ontario will access government student financial assistance through the Ontario Student Assistance Program (OSAP): [osap.gov.on.ca](http://osap.gov.on.ca). Students from a province or territory outside Ontario must apply for government student financial assistance through their home province or territory.

Other government student financial assistance programs include:

### **Canada Study Grant for the Accommodation of Students with Permanent Disabilities**

This program is designed to assist disabled students with disability-related costs of equipment and/or services associated with their participation in post-secondary studies. Students must first apply for funding from their applicable government student financial assistance program for the current academic year and must demonstrate financial need. Students must also be registered with the Health, Counselling and Disability Services Office at Queen's University.

### **OSAP Child-Care Bursary**

The OSAP Child-Care Bursary is provided to eligible Ontario students who, in relation to their participation in post-secondary studies, incur child-care costs for three or more children.

### **Ontario Special Bursary**

Ontario students with low income and enrolled in part-time studies (as defined by the government - maximum 59% of a full course load in each term of study) due to family responsibilities or other personal circumstances may be eligible. Students must be enrolled in a program leading to a degree or diploma and generally cannot have a previous post-secondary degree or diploma.

### **Part-time Canada Student Loan/Canada Study Grant (CSG) Program**

Canadian citizens and permanent residents with low income and enrolled in part-time studies (as defined by the government - maximum 59% of a full course load in each term of study) may be eligible. Students must be residents of a province or territory that participates in the Canada Student Loans program. To qualify for the CSG students must be studying part-time due to family responsibilities or other personal circumstances.

### **Work Study Program**

Queen's University and the Government of Ontario fund this program. The objective is to provide an opportunity for students in financial need to receive priority for certain part-time jobs, generally on-campus, during the academic terms. Applications for the Fall-Winter academic session are available in May and applications for the Spring-Summer academic session are available in February.

### **General Bursaries**

Queen's University bursary assistance is granted after the student's own financial contribution to the cost of his/her education, parental assistance, government aid assistance, or a bank line of credit have been exhausted. Financial need is the primary consideration in the granting of a bursary.

In order to be considered for the majority of Queen's bursaries, including the ones specifically pertaining to Engineering and Applied Science students, students need to complete a single General Bursary application form (unless otherwise noted in the terms of the awards), which is available from the Student Awards website. The deadline for this application is 31 October. If a student is not granted an Engineering and Applied Science bursary or award he/she is still eligible to receive General Bursary funds. Funds will be distributed at the beginning of Winter Term. Bursaries and awards are paid to the student's tuition account if a balance is owing, and any remaining funds are paid by cheque or electronic funds transfer. The values of the bursaries and awards are variable, unless otherwise noted. For complete terms of these, and other named bursaries and awards see the Student Awards website.

### **Short-term Loans**

Short-term loans (of 90 days or less) may be granted in emergency situations if a full-time student is experiencing temporary cash-flow difficulties and can provide satisfactory evidence that he/she will have sufficient resources to repay the loan on or before the due date. Short-term loans are approved on the basis of financial need to assist students in meeting those expenses normally incurred in support of attendance at the University during the current academic session.

### **Entrance Awards**

Queen's Entrance scholarships, bursaries and awards are not listed in this Calendar. Details on these awards are available on the Student Awards web-site or in the Viewbook brochure. The Viewbook should be available in the Guidance Offices of secondary schools or may be obtained by writing to the Office of the University Registrar (Admission Services), Queen's University, Kingston, ON K7L 3N6

### **Scholarships**

Queen's upper-year scholarships are generally available to full-time students in their respective faculty/school and who will be returning to full-time studies in the year following the award. For the most part, separate applications are not required. Candidates will be considered for those awards for which they are eligible in competition with all other qualified candidates. In instances where a scholarship application is required, specific instructions about the application process are given in the description of the award.

## **General Awards**

Queen's University bursary assistance is granted after the student's own financial contribution to the cost of his/her education, parental assistance, government aid assistance, or a bank line of credit have been exhausted. Financial need is the primary consideration in the granting of a bursary.

In order to be considered for the majority of Queen's bursaries, including the ones specifically pertaining to Engineering and Applied Science students, students need to complete a single General Bursary application form (unless otherwise noted in the terms of the awards), which is available from the Student Awards website at <http://www.queensu.ca/studentawards/>. The deadline for this application is 31 October. If a student is not granted an Engineering and Applied Science bursary or award he/she is still eligible to receive General Bursary funds. Funds will be distributed at the beginning of Winter Term. Bursaries and awards are paid to the student's tuition account if a balance is owing, and any remaining funds are paid by cheque or electronic funds transfer. The values of the bursaries and awards are variable, unless otherwise noted. For complete terms of these, and other named bursaries and awards see the Student Awards website.

## **First Year Awards**

### **William and Beatrice Alder Scholarships**

Awarded annually to students entering the second year of the Mathematics and Engineering program or the Engineering Physics program who have obtained First Class standing. Two awards are available.

### **William Coombs Baker Memorial Prize (Book Prize)**

Founded by graduates in memory of William Coombs Baker, formerly the Robert Waddell Professor of Experimental Physics at Queen's. Awarded annually to the student with the highest standing in APSC 111.

### **Robert Bruce Scholarships**

Established under the terms of the will of R. Bruce of Quebec and awarded annually on the basis of first-class standing to students entering second year. The award is renewable in third and fourth year providing satisfactory standing is maintained in the Faculty of Engineering and Applied Science. Two awards are available.

### **Eric R. Davis Memorial Award in Applied Science**

Established by friends and family in memory of Eric Davis, B.Sc.(Eng) 1950, former member of the Board of Trustees of Queen's University. Awarded on the basis of standing on year's work to a student entering second, third or fourth year in any program in the Faculty of Engineering and Applied Science.

### **R.L. Dorrance Memorial Scholarship in Chemistry**

Given by the Engineering Society for highest standing in first year Chemistry.

## **N.F. Dupuis Prize**

Founded by Science graduates, for standing in Mathematics.

## **G.B. Dyer/DuPont Canada Scholarships**

Established by DuPont Canada Inc. to recognize the significant contribution of Gerry B. Dyer, B.Sc.'52, D.Sc.'94, to the improvement and advancement of science education. Two scholarships will be awarded, one to a male and one to a female, who are Canadian or permanent residents and entering the second year of study in Chemical Engineering, Engineering Chemistry or Chemistry. Selection is based on high academic standing with consideration given to participation in the community or extra-curricular activities. In the case of students being equally eligible, financial need will be considered. Letters of application must be submitted by 15 April to the Heads of the Departments of Chemical Engineering or Chemistry who will then forward nominations by 1 May to their respective Scholarship Committee. **2 awards**

## **Lorne C. Elder Scholarship in Mechanical and Materials Engineering**

Established by Lorne C. Elder, B.Sc. 1942, and awarded on the basis of academic excellence to students entering second, third or fourth year in the Department of Mechanical and Materials Engineering.

## **J.E. Hawley Memorial Scholarship in Geological Sciences and Geological Engineering**

Established by Alban H. Norton, P.Eng. B.A. (Hons.) '36, in memory of J.E. Hawley, former Head of the Department of Geological Sciences. Awarded on the basis of academic excellence to a student registered in the second year of either the Geological Engineering program in the Faculty of Engineering and Applied Science or an Honours B.Sc. program in the Faculty of Arts and Science with a concentration in Geological Sciences. The candidate will be nominated by the Head of the Department of Geological Sciences and Geological Engineering.

## **H. Janzen Memorial Scholarship**

Established in memory of H. Janzen who taught in the Department of Physics at Queen's until his death in 1988. Awarded annually to the student entering the second year of the Engineering Physics program who attained the highest standing in the first year physics courses in Engineering and Applied Science.

## **The Nellie and Ralph Jeffery Awards in Mathematics**

Three or more scholarships are awarded, on the recommendation of the Department of Mathematics and Statistics, to undergraduate students majoring in Mathematics or Statistics. One of these shall be awarded to the student entering the fourth year of the Mathematics and Engineering program, or of an honours program with a Mathematics major, having the highest standing in the mathematics courses of the first three years and an overall first class average.

## **Annie Bentley Lillie Prizes in First Year Calculus**

Founded in memory of the late Annie Bentley Lillie. A number of book prizes to be awarded each year on the recommendation of the Department of Mathematics and Statistics to students with high standing in any first year calculus courses.

## **Jacob Malomet Memorial Scholarship**



Established by the family, friends and fellow-students of Jacob Daniel Malomet, who died in 1978 during his first year at Queen's. The award is presented annually to a first year Engineering and Applied Science student for general proficiency in term-length courses of the fall term.

### **Andrew McMahan Standards of Excellence Award**

Established in memory of Andrew M. McMahan Sc. '59, a former president of the Engineering Society and member of the Board of Trustees. Awarded annually in Applied Science on the basis of excellent academic achievement to a first year student in the top ten percent of the class who is entering second year. The recipient should demonstrate strong interpersonal skills, with a commitment to excel in all aspects of university life, and high personal standards. The recipient will be chosen by a Selection Committee, to be chaired by a member of the family, consisting of the Director (Program Development), one member of the business community and a family member. Candidates should submit a letter of application with supporting documents to the Faculty of Engineering and Applied Science by 31 March.

### **A.J. McNab Scholarship**

Given by Mr. A.J. McNab, this scholarship is awarded for standing in APSC 151, no failed courses. Open to students proceeding in Geological or Mining Engineering.

### **James L. Mason Cup**

Established March 2010 in recognition of James L. Mason, an Associate Dean in the Faculty of Applied Science from 1996 to 2008, who has been instrumental in establishing the program in team-based, project-based learning in the First Year which is now an integral part of the Engineering and Applied Science curriculum. The cup recognizes Dr. Mason's outstanding leadership, education insight and administrative skill in developing and implementing the Program.

Criteria:

To be eligible the winning team in all of its project work, must function as an effective team with broad participation;

- Exhibit a high degree of technical competence;
- Demonstrate awareness of the economic, social, and environmental factors relevant to whatever they do;
- Communicate their work both in writing and oral presentation in such a way that the principles guiding their choices are clear to both technical and non-technical audiences.

### **Dr. William Moffat Prize**

Founded by Dr. W. Moffat of Utica, N.Y., for second highest standing in APSC 131 and APSC 132.

### **William Wallace Near Scholarship**

Established under terms of the will of W.W. Near of Toronto, for standing on year's work.

### **George and Mary Louise Patton Scholarship**

Founded by G. Patton in memory of his wife and himself, for standing on year's work.

### **Ontario Professional Engineers Foundation for Education Scholarships**

Awarded by the Ontario Professional Engineers Foundation for Education, on the recommendation of the University's Faculty of Engineering and Applied Science; undergraduate (in course) scholarships to be awarded based on a combination of high academic achievement and demonstrated leadership in professional affairs and extracurricular activities. Applications are submitted to the Faculty of Engineering and Applied Science for selection by the Engineering and Operations Committee (Scholarships). **2 awards in each of years 1, 2, 3**

### **Polycorp Ltd./Kumar Scholarship in Mining Engineering**

Established in April 2007 by Polycorp Ltd. in recognition of Polycorp Ltd.'s Manager, Mining Products, Pramod Kumar, P.Eng. and in memory of his late father, Dr. Jiwan Lal Gupta. Awarded on the basis of academic excellence to a student entering second, third or fourth year of the Mining Engineering program in the Faculty of Engineering and Applied Science.

### **James H. Rattray Memorial Scholarships in Applied Science**

Established by Major James H. Rattray, M.C. Several scholarships are awarded annually on the basis of academic merit to students entering the second, third and fourth years of programs in the Faculty of Engineering and Applied Science.

### **Carl Reinhardt Scholarship**

To be awarded annually to a deserving student who enrolls in a second-year program leading to an honours B.Sc. degree with a concentration in Geological Sciences in the Faculty of Arts and Science, or who registers in the second year of the B.Sc. Geological Engineering program in the Faculty of Engineering and Applied Science.

### **Science 1941 Memorial Scholarship**

Maintained by the class of Science '41 in memory of Mr. J.O. Watts, for standing on year's work.

### **Science 1945 Memorial Scholarship**

Maintained by the Class of Science '45 as a memorial to members who gave their lives in World War II and awarded for standing on year's work. Two awards are available - one for standing on the first year's work and the other for standing on the second year's work.

### **Science 1946 Memorial Upper Year Scholarship**

Maintained by the Class of Science '46 as a memorial to members who gave their lives in World War II and awarded on the basis of academic excellence to a student entering second or third year in the Faculty of Engineering and Applied Science.

### **Robert F. Segsworth Scholarship in Mining Engineering**

Awarded at the beginning of the second year of the Mining Engineering program for general proficiency and renewable in the third and fourth years, provided satisfactory standing is maintained.

### **Raymond H. and Phyllis J. Smart Scholarships**

Established in January 2010 by a bequest from the Estate of Phyllis J. Smart and awarded on the basis of academic excellence to students entering second, third or fourth year in the Faculty of Engineering and Applied Science. Selection will be made by the Engineering and Applied Science Operations Committee (Scholarships).

### **Stantec Award in Civil Engineering**

Established in May 2006 by Stantec Consulting Ltd., and awarded to a full-time student entering the second or third year of the Civil Engineering program in the Faculty of Engineering and Applied Science on the basis of academic excellence and involvement in extracurricular activities specifically related to the Department, Faculty, or the University. Application must be submitted by letter to the Head of the Department of Civil Engineering by 31 March.

### **Ho Ming Tai Memorial Scholarship**

Established by the family in memory of Ho Min Tai, Sci '83, who died tragically when Korean Air Lines Flight 007 was shot down on 1 September 1983. Awarded on the basis of standing in first year to an international student who is studying Electrical Engineering or Computer Engineering on a student authorization or a student visa and is subject to the payment of higher tuition fees. The scholarship will be renewed in the third and fourth years provided honours standing is maintained.

### **Adam Wallgren Memorial Award**

Founded by Science '90 in memory of Adam Wallgren and awarded to a first year engineering student who through his/her kind actions and friendly disposition eased the rigors of day-to-day life in first year. Written nominations should be submitted to the Engineering Society no later than 15 February. The recipient shall be selected by the Engineering Society Awards Committee, in consultation with the Dean, and awarded at the Engineering Society's Annual Retreat.

### **George Thomas Warren Scholarship in Computer Engineering**

Established in October 2000 by Mrs. Evelyn Warren, in memory of her husband, George Thomas Warren, B.Sc. (Eng.) 1938. Awarded on the basis of academic excellence to full-time students entering second year of the Computer Engineering program in the Faculty of Engineering and Applied Science.

### **Morley E. Wilson Scholarship in Geological Sciences and Geological Engineering**

Established by a bequest from the estate of Morley E. Wilson, and awarded on the basis of standing at the end of the first year to a student entering the second year of a B.Sc. program in Geological Engineering or an Honours B.Sc. program with a concentration in Geological Sciences. The award is in two parts, one-half on entrance to the second year program and one-half on entrance to the third year program, provided that the student maintains an average of at least 75 percent.

### **Second Year Awards**

#### **American Society for Metals Scholarship in Mechanical Engineering (Kingston Chapter)**

Established by The Kingston Chapter of the American Society for Metals to provide an annual scholarship to a full-time student entering the third year of the Materials Option in the Mechanical Engineering program in the Faculty of Engineering and Applied Science. Awarded to the student with the highest cumulative average.

## **Manley B. Baker Scholarships in Geology**

Founded by Agnes Moreland Baker. Two scholarships awarded annually to the students in the Faculty of Arts and Science or Engineering and Applied Science, obtaining the highest and second highest standing in the geology courses of the first and second years of their respective programs. These scholarships are open only to students taking a program leading to an honours B.Sc. degree with a concentration in Geological Sciences in Arts and Science or to a B.Sc. in Geological Engineering in Engineering and Applied Science.

## **Donovan Brown Scholarship in Applied Science**

Established in May 2006 by Alice J. Brown in memory of her husband, Donovan Brown, B.Sc. (Engineering Chemistry) 1949, and awarded on the basis of academic excellence to student(s) entering the third or fourth year of any Engineering program in the Faculty of Engineering and Applied Science. Selection will be made by the Engineering and Applied Science Operations Committee (Scholarships).

## **Orville and Carmel Brown Scholarship**

Established by Orville and Carmel Brown and awarded to a student in any year of the Engineering Physics program on the basis of academic excellence. The recipient must be a Canadian citizen or landed immigrant, and if possible, a resident of Lennox and Addington, Frontenac or Leeds and Grenville counties. Selection will be made by the Engineering Physics Department.

## **Dr. Erwin Buncel Scholarship in Chemistry**

Established in September 2008 by the family of Dr. Erwin Buncel, a distinguished professor of organic chemistry in the Department of Chemistry since 1962, in memory of Ignacz, Irena and Marta Buncel. Awarded to a student in an Honours Chemistry or Environmental Chemistry program (Faculty of Arts and Science), or Engineering Chemistry program (Faculty of Engineering and Applied Science), entering third year with the highest combined average standing in either CHEM 222 and CHEM 223 (Arts and Science), or ENCH 222 and ENCH 245.

## **Cameron Applied Science Scholarship**

Established in February 2006 by Hugh Cameron, B.Sc. 1973, and Heather Hume, B.A. 1972, M.D. 1978, to provide an award on the basis of academic excellence to students entering third or fourth year of any program in the Faculty of Engineering and Applied Science who has applied their engineering knowledge and/or techniques in an innovative manner related to non-traditional engineering fields. Nominations may be made by faculty members or students should apply by letter, with attached resume, to the Faculty of Engineering and Applied Science by 1 October.

## **Harold M. Cave Undergraduate Travel Scholarship**

Established in June 2014 by the estate of Harold M. Cave, B.A. 1925, M.A. 1926 and awarded on the basis of academic excellence to students in any undergraduate year of an honours degree in Physics or Astronomy in the Faculty of Arts and Science or an honours degree in Engineering Physics in the Faculty of Engineering and Applied Science. Awarded to students for the purpose of attending the Canadian Undergraduate Physics Conference or other equivalent conference. Funds are to be used to cover conference fees and travel related expenses. Selection will be made by the Scholarship Committee of the Department of Physics, Engineering Physics & Astronomy. Applicants are to submit a letter of application to the Department of Physics, Engineering Physics & Astronomy by 30 September.

## **ConeTec Geotechnical Award**

Established in October 2012 by ConeTec Investigations Ltd. and awarded to students registered in second or third year in any undergraduate academic plan in Civil Engineering, Mining Engineering and/or Geological Engineering in the Faculty of Engineering and Applied Science. The student recipient must have demonstrated leadership, curiosity and independent thinking, and have indicated a desire and suitability to pursue fieldwork and field-based research. A letter of application, along with a one to two page submission outlining their interests and engagement in geotechnical engineering, for example, through courses taken, co-curricular activities, and/or summer employment, is to be submitted to the Faculty of Engineering and Applied Science by 1 February for selection by the Operations Committee (Scholarships). Recipients will also be invited to apply for a paid summer internship experience for a period of 12-16 weeks at one of ConeTec's North American field operations; acceptance of employment is not a condition of this award.

### **ConeTec Geotechnical Award in Mining Engineering**

Established in October 2014 by ConeTec Investigations Ltd. and awarded on the basis of academic achievement to undergraduate students in second or third year of the undergraduate program in Mining Engineering in the Faculty of Engineering and Applied Science. The student recipient must have demonstrated leadership, curiosity and independent thinking, and have indicated a desire and suitability to pursue fieldwork and field based research. A letter of application, along with a one to two page submission outlining their interests and engagement in geotechnical engineering through courses taken, co-curricular activities and/or summer employment, is to be submitted to the Faculty of Engineering and Applied Science by 1 February for selection by the Operations Committee (Scholarships). Recipients will also be invited to apply for a paid summer internship experience for a period of 12-16 weeks at one of ConeTec's North American field operations; acceptance of employment is not a condition of this award.

### **Engineering Chemistry Industrial Scholarship**

Established in February 2010 to recognize the industrial practice of engineering chemistry, as embodied by the DuPont Industrial Research Chair held by Dr. Warren Baker from 1985-1995 in the Department of Chemistry at Queen's. Awarded to a student entering third year of the Engineering Chemistry program in the Faculty of Engineering and Applied Science on the basis of academic excellence in the second year of the Engineering Chemistry program, who does not hold a scholarship of greater value from Queen's University. Selection will be made by the Operations Committee (Scholarships) of Engineering and Applied Science on the recommendation of the Head and Chair of Undergraduate Studies in the Department of Chemical Engineering.

### **Isaac Cohen Scholarship**

Given by Mr. Isaac Cohen for standing on year's work. Open to candidates in Civil Engineering.

### **H. Arnold Cowan Scholarship**

Established in December 2005 from the estate of Ellen Harcourt Boyd in memory of her husband H. Arnold Cowan. Awarded on the basis of academic excellence to students entering the third or fourth year of any Engineering program in the Faculty of Engineering and Applied Science. Selection will be made by the Engineering and Applied Science Operations Committee (Scholarships).

### **Eric R. Davis Memorial Award in Applied Science**

Details of this award are given in the section on *First Year Awards*.

### **Parsons Inc. Scholarship (formally named the Delcan Corporation Scholarship in Applied Science)**

Established in October 2006 by Parker & Associates Inc. and awarded on the basis of academic excellence, demonstrated initiative and leadership, to students entering the third or fourth year of studies in the Faculty of Engineering and Applied Science. Students in second or third year of studies submit their applications to the respective Head of their Department by 31 March. Selection will be made by Faculty of Engineering and Applied Science Operations Committee (Scholarships).

### **J.J. Denny Memorial Scholarship**

Founded by Mrs. J.J. Denny and by the Classes of '03-'06 and other friends of James Denny, M.Sc.'21, for standing on year's work. On the recommendation of the Department of Mining Engineering, two awards are made, one in the 'mining option' and the other in the 'mineral processing option', with preference given to students in their second year.

### **J.J. Denny Memorial Scholarship in Geological Engineering**

Established from the sale of gold nuggets donated by Mrs. J.J. Denny in memory of James Denny, M.Sc. '21, and awarded on the basis of academic performance in the second year to two students entering the third year of a program in Geological Engineering. The scholarships are awarded on the recommendation of the department and students entering fourth year may be chosen if there are no suitable candidates entering third year.

### **Charles W. Drury Scholarship**

The will of C.W. Drury, B.Sc. 1909, provides for this scholarship. Open to students entering third or fourth year of the Materials Option in Mechanical Engineering. Awarded on the recommendation of the Department of Mechanical and Materials Engineering mainly for academic excellence but consideration will be given for evidence of additional traits desirable in a professional engineer.

### **Lorne C. Elder Scholarship in Mechanical and Materials Engineering**

Details of these awards are given in the section on *First Year Awards*.

### **Endeavour Silver Corp. Scholarship**

Established in January 2012 by Endeavour Silver Corp. and awarded on the basis of academic excellence to students entering third or fourth year in the Geological Sciences program in the Faculty of Arts and Science, or the Geological Engineering program in the Faculty of Engineering and Applied Science. Selection will be made by the Undergraduate Scholarship Committee in the Department of Geological Sciences and Geological Engineering.

### **Engineering Society Prize**

Given by the Engineering Society to the student in second year Engineering who has exhibited the most ability in non-athletic extracurricular leadership and activity. Recipient is chosen in consultation with the Engineering Society Awards Committee.

### **Fluor Canada Ltd. Scholarship**

Established in September 2009 by Fluor Canada Ltd. Awarded on the basis of academic excellence to full-time students who are Canadian citizens or permanent residents entering the third or fourth year of the Chemical Engineering, Electrical and Computer Engineering, Mechanical or Civil Engineering program in the Faculty of Engineering and Applied Science.

## **Les Gulko Award**

Awarded on the recommendation of the Department of Mathematics and Statistics to a student entering the third year of the Mathematics and Engineering program, based on academic performance in the second year. At the discretion of the Department, the award may be divided equally between two qualified candidates.

## **J.C. Gwillim Prize**

Awarded for standing on year's work to candidates in Mining Engineering.

## **Robert Hall Memorial Award**

Founded by the class of Science '86 and the Queen's Mining Club in memory of Robert Hall, a member of Science '86. Awarded on the basis of interest in the Engineering Society, participation in intramural or intercollegiate sports and the demonstration of those qualities exemplified by Robert Hall: spirit, fellowship and enthusiasm. The recipient will have passed all the courses of the First Year and maintained a full academic program in the second year. Selection is by the Engineering Society from nominations made by the engineering student body. A replica of the commemorative plaque will be presented annually in March with the award.

## **Mike Hamze Memorial Scholarship**

Established in March 2002 by friends, family and co-workers in memory of Mike Hamze, B.Sc. 1997 (Eng.). Awarded to a student entering the third or fourth year in the Civil Engineering program in the Faculty of Applied Science based on academic merit and community involvement. Applicants should submit a letter of application, along with a resume, to the Head of the Department of Civil Engineering by 31 March.

## **James Hickey Memorial Prize**

Established by Mr. and Mrs. J.W. Hickey, Marmora, Ontario, in memory of their son, James Hickey, for standing in MECH 213.

## **Lawrence M. Hunter Memorial Award**

Established by John L. Hunter, B.Sc. 1969, in memory of his father, Lawrence M. Hunter, B.Sc. 1936 and awarded to a student entering the third or fourth year of studies in the Faculty of Applied Science, who has made outstanding humanitarian contributions as evidenced through volunteer activities both within and outside of the university environment while maintaining satisfactory academic achievement. Preference will be given to candidates who have not received other University awards of higher value. This award may be received only once by an individual. Students in second year or third year of studies submit their application by letter, accompanied by a resume and two letters of reference, one of which must be from an individual who can attest to the student's humanitarian efforts and submitted to the Faculty of Engineering and Applied Science by 31 March.

## **Ingenium Group/Joe Dominik Scholarship**

Established in May 2005 by the Ingenium Group in memory of Joe Dominik, a Queen's alumnus and local Kingston Architect. Awarded on the basis of academic excellence to a full-time student entering the third year of study in the Department of Electrical and Computer Engineering in the Faculty of Engineering and Applied Science.

## **Nellie and Ralph Jeffery Awards in Mathematics**

Details of these awards are given in the section on *Third Year Awards*.

### **Shirley C. Kennedy Scholarship in Civil Engineering**

*Established in November 2006 memory of Shirley C. Kennedy, Arts 1940, and awarded on the basis of academic excellence to a full-time undergraduate or graduate student in the Department of Civil Engineering. Selection will be made by the Departmental Awards Committee.*

### **KGHM International Ltd. Scholarship**

Established in March 2012 by KGHM International Ltd. and awarded on the basis of academic excellence and proven leadership skills, to undergraduate students registered in the Geological Engineering program or the Mining Engineering program in the Faculty of Engineering and Applied Science. A letter of application outlining interest and engagement in the mining industry, as well as a resume is to be submitted to the Office of the University Registrar, Student Awards, by 1 March. Selection will be made by a Committee comprised of faculty members from the Department of Geological Sciences and Geological Engineering and the Robert M. Buchan Department of Mining.

### **Cyril W. Knight Scholarship**

A bequest by Douglas G.H. Wright, awarded to student who attains the highest Grade Point Average in all science and engineering courses in both first and second years of the program.

### **Kostuik Scholarship in Mining Engineering**

Established by Anne and John Kostuik, B.Sc. Eng. '34, and awarded on the basis of academic standing to one student entering the third year and one student entering the final year of the Mining Engineering program.

### **Frank B. Lee Memorial Scholarship in Engineering**

Established by friends and family in memory of Frank B. Lee, B.Sc. 1945. Awarded on the basis of high academic standing to a student entering the third year of any engineering program in the Faculty of Engineering and Applied Science.

### **Ian Joseph MacDonald Scholarship in Mechanical Engineering**

Founded in memory of Dr. Ian J. MacDonald, Sc. '54, awarded to the Mechanical Engineering student completing second year with the highest aggregate mark in the courses in Statics, Kinematics, Dynamics, and Solid Mechanics.

### **Clifton Campbell MacKinnon and Barbara Claire Adsit MacKinnon Prize in Mechanical Engineering**

Established by the family of the late C.C. MacKinnon, Science '36. Awarded to the second year Mechanical Engineering student with the highest standing on the year's work.

### **Alexander Macphail Scholarship**

Maintained by the Class of Science '14, for standing on year's work.



## **Michele Mainland Memorial Scholarship in Chemical Engineering**

Established in memory of Michele Mainland, B.Sc. '97, by family, friends and fellow students to honour Michele's love of learning and education. Two awards are given annually to students in second and third year Chemical Engineering with the highest overall standing on year's work.

## **Roberta McCulloch Prize in English**

Founded by the late Andrew McCulloch of Thorold. Awarded to the student in second, third or fourth year Engineering and Applied Science who achieves the highest standing in an English course.

## **McLean Family Award in Student Design**

Established in March 2007 by the McLean family in honour of Kenneth Mclean, B.S.c (Eng. Phys.) 2005, in appreciation for the valuable team experiences and life lessons learned from his active participation with the Queen's Solar Vehicle Team from 2001 to 2005. Awarded to an upper year student in the Faculty of Engineering and Applied Science who has a cumulative average of at least 65% and who is actively involved on a student design team, with preference to students who are members of the Solar Vehicle Team. Preference will be given to students whose address on admission to Queen's was from outside the province of Ontario. Application is by letter, along with a written endorsement by a design team faculty member, to the Faculty of Engineering and Applied Science by 31 March. The recipient shall be selected by the Engineering and Applied Science Operations Committee (Scholarships).

## **Mining 1988 Scholarship**

Awarded, on the recommendation of the Head of the Robert M. Buchan Department of Mining, to a student entering third or fourth year of the Mining Engineering academic plan in the Faculty of Engineering and Applied Science who demonstrates good character and strong industry leadership potential, a keen interest and aptitude for his or her studies in mining engineering and the desire and ambition to truly make a difference in the global metals and minerals industry. Consideration will also be given for the candidate's involvement in extracurricular activities at Queen's, school spirit and impact on class camaraderie.

## **Modular Mining Systems Scholarships**

Established in April 2012 by Modular Mining Systems and awarded on the basis of academic excellence to an undergraduate student entering second or third year in the Mining Engineering Option of the Mining Program in the Faculty of Engineering and Applied Science, and to an undergraduate student entering second or third year in the Mining-Mechanical Option of the Mining Program in the Faculty of Engineering and Applied Science. Selection will be made by the Faculty of Engineering and Applied Science Operations Committee (Scholarships). Two awards available.

## **R.T. Mohan Undergraduate Scholarship in Chemistry**

Awarded to a promising student entering the third or fourth year of the Engineering Chemistry program in the Faculty of Engineering and Applied Science or the Honours Chemistry program in the Faculty of Arts and Science, provided that the recipient has first class standing. At the discretion of the Department, the scholarship may be divided equally between two qualified candidates. A Mohan Scholar may be eligible for renewal of the award once only in competition with other qualified candidates.

## **Mowat Prize**

Founded by John McDonald Mowat for standing on year's work.

### **Frank S. Pichler Memorial Scholarship**

Established in April 2012 by Sherly Pichler in memory of her husband Frank S. Pichler, B.Sc. (Eng) 1983. Awarded on the basis of academic excellence to students entering third or fourth year in the Robert M. Buchan Department of Mining. Selection will be made by the Engineering and Applied Science Operations Committee (Scholarships).

### **William Wallace Near Scholarship**

Established under the terms of the will of W.W. Near of Toronto, for standing on year's work.

### **Emil Nenniger International Exchange Scholarship in Chemical Engineering**

Established in 2004 by Dr. Emil Nenniger, B.Sc. '50 and awarded on the basis of academic excellence to a student entering third year in the Department of Chemical Engineering or Engineering Chemistry in the Faculty of Engineering and Applied Science, who has been selected to participate in an official exchange program at a location outside Canada. Letters of application must be submitted to the Head of Chemical Engineering by 1 March. Selection will be made by the Departmental Scholarships Committee.

### **Dr. William H. Nichols Prize in Chemistry**

Founded by Mr. C.W. Nichols in memory of his father, Dr. William H. Nicols. Awarded annually to a student in the Faculty of Engineering and Applied Science or in the Faculty of Arts and Science who has attained the highest standing in CHEM 213.

### **Northeastern Chemical Association Scholarship**

Established by Northeastern Chemical Association, Inc. and awarded to a full-time undergraduate student enrolled in Chemical Engineering, Engineering Chemistry or Chemistry on the basis of academic performance and interest in science issues. Students must submit a letter of application outlining goals, interests, career objectives and experience to the Head of their Department by 15 March, who will then forward nominations by 1 April to their respective Scholarship Committee.

### **Novelis Scholarship**

Established in April 2006 by Novelis Inc. Two scholarships will be granted to students in the penultimate or final year on the basis of academic excellence. One scholarship will alternate between the School of Business and the Faculty of Arts and Science (Chemistry, Economics, Geological Sciences or Physics). The scholarship will be awarded to a student in the Faculty of Arts and Science in even numbered years and to a student in the Bachelor of Commerce program in odd numbered years. **One scholarship will be awarded to a student in any program of Engineering in the Faculty of Engineering and Applied Science.** Preference will be given to children of Novelis employees who have applied by letter to the Associate University Registrar (Student Awards) by 1 March. If there are no eligible children of Novelis employees, the selection will be made by the Awards Committee of the faculties.

### **O'Connor Associates Scholarship in Geological Engineering**

Established by O'Connor Associates Environmental Inc. and awarded to a student entering the third year of the Geological Engineering program, Geo-environmental Option. Selection will be based on a strong academic record, a

keen interest in environmental issues, and participation in student activities. The scholarship recipient will be selected by the Geo-environmental Engineering Steering Committee, in consultation with second year instructors. If there is no suitable candidate entering third year, the scholarship may be awarded to a student entering fourth year.

### **Ontario Power Generation Award**

Established by Ontario Power Generation and awarded to a student who at the time of application is registered in second year in any program in the Faculty of Engineering and Applied Science. The recipient must be a Canadian citizen or a landed immigrant to be eligible. Selection will be based on academic achievement, strong oral and written communication skills, leadership ability and involvement in extra-curricular activities. The recipient must be a member of the employment equity target groups (women, aboriginal, disabled, visible minority) and cannot hold more than one other award of equal or greater approximate value. Candidates should submit a letter of application to the Head of Departments by 31 January and selection will be made by the Engineering and Applied Science Operations Committee (Scholarships).

### **Ontario Professional Engineers Foundation for Education Scholarships**

Details of this award are given in the section on *First Year Awards*.

### **David Parkes Scholarship in Applied Science**

Established by David Parkes, B.Sc. 1968, and awarded on the basis of academic excellence to a full-time upper year student in the Faculty of Engineering and Applied Science.

### **Polycorp Ltd./Kumar Scholarship in Mining Engineering**

Details of this award are given in the section on First Year Awards.

### **Queen's C.A.P. Prize Examination Award**

Established in April 2008 by the Department of Physics, Engineering Physics and Astronomy, and awarded annually to students based on their academic performance in the nationwide Canadian Association of Physicists University Prize Examination. Awarded to first and second ranked students in each of second, third, and fourth year of undergraduate studies in the Department of Physics, Engineering Physics and Astronomy. Selection of award recipients will be based on the recommendation of the Department of Physics, Engineering Physics and Astronomy.

### **QUIP International Tuition Award**

Established in November 2007 by the Faculty of Engineering and Applied Science and awarded on the basis of academic achievement to international students participating in the Queen's University Internship Program (QUIP).

### **James H. Rattray Memorial Scholarships in Applied Science**

Details of this award are given in the section on *First Year Awards*.

### **Alvin Craig Ross Memorial Scholarships in Mineral Processing**

Established in memory of Alvin Craig Ross by his father, Mr. A.H. Ross, B.Sc.(Eng.)<sup>36</sup>. One scholarship is awarded annually on the completion of the second year and one on the completion of the third year, to candidates enrolled in

Mining Engineering, who are Canadian citizens resident in Canada who have demonstrated an interest in the field of extractive metallurgy and have expressed an intention of making a career in the mining industry in Canada. Selection is based on academic standing, character, personal initiative and industry, and reliability. Financial need will only be considered if two applicants exist with comparable other qualifications. Candidates will be recommended to the Engineering and Applied Science Operations Committee by a committee composed of the Dean of Engineering and Applied Science and Head of the Mining Engineering, by 1 May.

### **Science 1911 Prize**

Awarded for standing on year's work.

### **Science 1922 Scholarship**

Maintained by the Class of Science '22, for standing on year's work.

### **Science 1945 Memorial Scholarship**

Details of this award are given in the section on *First Year Awards*.

### **Science 1946 Memorial Upper Year Scholarship**

The Science 1946 Memorial Upper Year Scholarship is maintained by the Class of Science '46 as a memorial to members who gave their lives in World War II. Awarded on the basis of academic excellence to a student entering second or third year in the Faculty of Engineering and Applied Science.

### **Science 1948 S.N. Graham Award**

Founded by the class of Science '48 in honour of Professor S.N. Graham. Awarded on the completion of the second year to a student with a sound academic record who has demonstrated outstanding performance in extra-curricular activities on campus. Nominations are to be made by Heads of Departments by 31 March, who will then forward their nomination to the the Faculty of Engineering and Applied Science for selection by the Operations Committee (Scholarships).

### **A.E. Segsworth Prize**

Founded by R.F. Segsworth of Toronto in memory of his brother. Open to a student in any year on the basis of the best essay describing his or her experiences in practical underground mining. Essays to be submitted by 31 March to the Robert Buchan Department of Mining.

### **Raymond H. and Phyllis J. Smart Scholarships**

Details of this award are given in the section on *First Year Awards*.

### **Carolyn F. Small Memorial Award for Design Innovation**

Awarded on the basis of demonstrated outstanding creativity in the practice of engineering design to an individual or a group of students at Queen's University who are directly involved with academic or sponsored extracurricular design efforts associated with or funded by the Faculty of Engineering and Applied Science.

## **Robert E. Smith Memorial Scholarship in Mining Engineering**

Established by the family and friends of Robert Evan Smith, a Queen's Mining Engineer, who died in a tragic mining accident shortly after graduation in 1984. Awarded to a full-time Canadian student entering the third or fourth year. The recipient will be one who conscientiously contributes to all aspects of university life, while maintaining good academic standing and who exhibits cheerful enthusiasm and a positive attitude towards the Mining Engineering program and the mining industry in general. Financial need will also be taken into consideration, as will the recipient's personality and compassion towards fellow students. Selection will be made by the Head of the Department of Mining Engineering in consultation with appropriate instructors.

## **Stantec Award in Civil Engineering**

Details of this award are given in the section on *First Year Awards*.

## **Alice Pierce Waddington Scholarship**

Open to students in Civil Engineering specializing in building construction. Awarded on scholastic ability and attainment, integrity of character and purpose.

## **William E. White Scholarships in Geological Sciences and Geological Engineering**

Established by a bequest from the estate of William E. White, B.A. (1929), B.A. (Hons) 1930, and Medalist in Geology. Awarded to students in the second year, or students entering third or fourth year of a program leading to B.Sc. degree with a concentration in Geological Sciences in the Faculty of Arts and Science or a B.Sc. degree in Geological Engineering in the Faculty of Engineering and Applied Science. Awards are based on academic achievement and contribution to the Department as judged by the Head of the Department in consultation with the Department's teaching staff. **Awards to second-year students are made in January** based on performance in GEOL 211 or 221 and GEOL 232. **Awards to third-and fourth-year students are made in the Spring.**

## **W.P. Wilgar Memorial Scholarship**

Maintained by the classes of Science '03-'06 and other friends of W.P. Wilgar, B.Sc. '03, for standing on year's work.

## **Marion and Arthur Wonnacott Scholarship**

Established in September 2008 from the estate of Marion Wonnacott and Arthur Wonnacott, B.A. 1934. **Two awards will be made each year**, one to a student in Arts and Science who achieves the highest combined average in MATH 280 and 281 taken in the same year and one to the student in Engineering and Applied Science who achieves the highest combined average in MTHE 280 and MTHE 281.

## **Third Year Awards**

### **Joseph Abramsky Prize**

Founded in memory of Joseph Abramsky by his sons, for standing on year's work. Open to candidates in Mechanical Engineering.

### **Accenture in Applied Science Scholarship**

Established in May 2002 by Accenture Inc. and awarded to a student entering fourth year in the Faculty of Applied Science. Selection will be made on the basis of academic excellence and leadership in extracurricular activities, such as professional or social organizations, sports, or part-time employment. Preference will be given to students who have had exposure to a consulting business or initiative in the past. Application is by letter with attached resume to the Faculty of Engineering and Applied Science by 31 March for selection by the Operations Committee (Scholarships).

### **Frederick and Christopher Ansley Scholarship**

Established by Peter Ansley's family in honour of his father Frederick C. Ansley, B.Sc. (Eng.) 1937 and brother Christopher Ansley, B.Sc (Eng.) 1969, and awarded to a student entering the fourth year of the Civil Engineering program. Selection will be based on academic excellence and contribution to the betterment of campus life through interest in the student chapters of the profession, Engineering Society, campus activities and community affairs. Applications and nominations should be submitted to the Head of the Department of Civil Engineering by 1 March. Selection will be made by the Departmental Awards Committee.

### **Leonard G. Berry Memorial Award**

Established by the family, colleagues, friends and former students of the late Professor Leonard G. Berry, professor of mineralogy at Queen's University from 1944 to 1980, as a tribute to his outstanding contributions to mineralogical science and his devotion as a teacher. Awarded, on the recommendation of the Department of Geological Sciences and Geological Engineering, to a senior undergraduate student with a strong academic record and a demonstrated interest in mineralogy. To be eligible, the student must be enrolled in an honours B.Sc. program with a concentration in Geological Sciences in the Faculty of Arts and Science, or in Geological Engineering in the Faculty of Engineering and Applied Science.

### **Donovan Brown Scholarship in Applied Science**

Details of this award are given in the section on *Second Year Awards*.

### **Orville and Carmel Brown Scholarship**

Details of this award are given in the section on *Second Year Awards*.

### **Erwin Buncel Scholarship in Chemistry**

Details of this award are given in the section on *Second Year Awards*.

### **Cameron Applied Science Scholarship**

Details of this award are given in the section on *Second Year Awards*.

### **Kenneth B. Carruthers Scholarship in Mechanical Engineering**

Founded in memory of Major K.B. Carruthers, B.Sc., for standing on year's work. Open to candidates in Mechanical Engineering, Materials option.

### **Kenneth B. Carruthers Scholarship in Mining Engineering**

Founded in memory of Major K.B. Carruthers, B.Sc., for standing on year's work. Open to candidates in Mining Engineering.

### **Harold M. Cave Scholarship in Experimental Physics**

Established in memory of Harold M. Cave, M.A. (Queen's), Ph.D. (Cantab), who taught in the Physics Department from 1930 until years after his retirement in 1967. Two scholarships are awarded annually to students with first class standing, one entering the third year leading to a B.Sc. degree in Engineering Physics and one entering the third year of a B.Sc. (Honours) program in Arts and Science with a concentration in Physics. The awards will be based on achievement in experimental work as judged by the Department of Physics.

### **Harold M. Cave Undergraduate Travel Scholarship**

Details of this award are given in the section on *Second Year Awards*.

### **CMC Electronics Scholarship**

Established by the Canadian Marconi Company, this scholarship is awarded annually to a student with high academic standing in the third year of an Electrical or Computer Engineering program in the Faculty of Engineering and Applied Science.

### **Harold Arthur Cohen Book Prize in Engineering Physics**

Established by the family in memory of Harold Arthur Cohen, B.A. 1928, B.Sc. 1930 (Engineering Physics). Awarded to a student entering the fourth year of Engineering Physics who shows the most promise for inventiveness and discovery in Engineering Physics, as determined by the Chair of the Engineering Physics program.

### **ConeTec Geotechnical Award**

Details of this award are given in the section on *Second Year Awards*.

### **ConeTec Geotechnical Award in Mining Engineering**

Details of this award are given in the section on *Second Year Awards*.

### **H. Arnold Cowan Scholarship**

Details of this award are given in the section on *Second Year Awards*.

### **Eric R. Davis Memorial Award in Applied Science**

Details of this award are given in the section on *First Year Awards*.

### **Delcan Corporation Scholarship in Applied Science**

Details of this award are given in the section on *Second Year Awards*.

## **John Deere Foundation of Canada Scholarship in Mechanical Engineering and Commerce**

Established by the John Deere Foundation of Canada and awarded on the basis of academic merit to a student entering the final year of the Mechanical Engineering program in the Faculty of Engineering and Applied Science or to a student entering the final year of the Commerce program in the School of Business. The award will be presented to a student in Mechanical Engineering in even-numbered years and to a student in Commerce in odd-numbered years.

## **J. Allan Donaldson Prize in Geology**

Established by J. Allan Donaldson, B.Sc. 1956, and awarded to a student entering the fourth year in either an Honours B.Sc. program in the Faculty of Arts and Science with a concentration in Geological Sciences or in the Geological Engineering program in the Faculty of Applied Science. If there are no eligible recipients the award can be given to a student entering third year. The recipient of the award will have demonstrated an involvement and ongoing interest in the broad area of Precambrian geology, as demonstrated by coursework and/or summer field employment. The recipient will be chosen by the Head of the Department of Geological Sciences and Geological Engineering, in consultation with the Chairs of Arts and Science for Geology and Engineering and Applied Science for Geological Engineering.

## **Drilling and Blasting Scholarship**

Established in October 2012 by Jamie Archibald and the Rock Mechanics Group of the Robert M. Buchan Department of Mining to honour those in the mining industry who strive to augment explosives technology training and enhance the safety of all who participate in explosives applications within this industry. Awarded on the basis of academic excellence in MINE 321 (Drilling and Blasting) to students entering year four in the Mining Engineering program in the Robert M. Buchan Department of Mining. Selection will be made by the Faculty of Engineering and Applied Science Operations Committee (Scholarships).

## **Charles W. Drury Scholarship**

The will of C.W. Drury, B.Sc. (Queen's)'09, provides for this scholarship. Open to students entering third or fourth year of the Materials Option in Mechanical Engineering. Awarded on recommendation of the Department of Mechanical and Materials Engineering mainly for academic excellence but consideration will be given for evidence of additional traits desirable in a professional engineer.

## **Endeavour Silver Corp. Scholarship**

Details of this award are given in the section on *Second Year Awards*

## **Engineering Physics Award**

Awarded to a student, with at least second class standing, entering preferably the third or alternatively the fourth year of the Engineering Physics program whose total awards, administered by Queen's University, will not exceed twice the tuition fees for Canadian residents. The award is restricted to women until such time as 50 percent of the students registered in Engineering Physics are women. Applications should be made by 31 March to the advisor of Engineering Physics, who will make the nomination on behalf of the Department.

## **Expo 1986 Award**



Established to commemorate the 1986 International Exposition held in Vancouver, and the Innovative Vehicle Design Competition held during the exposition, in which the team from Queen's University received fourth prize. Awarded on the recommendation of the Dean in consultation with the Engineering Society to a student entering the final year of a program in Mechanical Engineering, Electrical Engineering or Computer Engineering. Selection will be on the basis of academic standing, a demonstrated ability in innovative engineering design, and participation in extra-curricular activities. Applications must be submitted to the Faculty of Engineering and Applied Science for selection by the Operations Committee (Scholarships) by 31 March.

### **Fifth Field Company Prize**

Provided from funds accumulated by members of the unit since World War I. Awarded to student in Civil Engineering standing highest in third year course in hydraulics.

### **Fluor Canada Ltd. Scholarship**

Details of this award are given in the section on *Second Year Awards*.

### **J. Nelson Gibson, B.Sc., Memorial**

Awarded by Department of Mechanical Engineering to student entering fourth year Mechanical Engineering; consideration given to academic status and need.

### **Mike Hamze Memorial Scholarship**

Established in March 2002 by friends, family and co-workers in memory of Mike Hamze, B.Sc. 1997 (Eng.) Awarded to a student entering the third or fourth year in the Civil Engineering program in the Faculty of Engineering and Applied Science based on academic merit and community involvement. Applicants should submit a letter of application, along with a resume, to the Head of the Department of Civil Engineering by 31 March.

### **Wm. Roy Hardick Scholarship**

Established through the estate of Mr. Wm. Roy Hardick, B.A. 1933, M.A. 1934. Two scholarships are awarded on the basis of academic excellence: one scholarship to an undergraduate student entering fourth year in the Faculty of Arts and Science with a concentration in Mathematics and Statistics and one scholarship to an undergraduate student entering fourth year in the Faculty of Engineering and Applied Science in the Mathematics and Engineering program.

### **Lawrence M. Hunter Memorial Award**

Details of this award are given in the section on *Second Year Awards*.

### **Nellie and Ralph Jeffery Awards in Mathematics**

Details of this award are given in the section on *Second Year Awards*.

### **Shirley C. Kennedy Scholarship in Civil Engineering**

Details of this award are given in the section on *Second Year Awards*.

## **KGHM International Ltd. Scholarship**

Details of this award are given in the section on *Second Year Awards*.

## **The Kostuik Scholarship in Mining Engineering**

Details of this award are given in the section on *Second Year Awards*.

## **Mark Latham Memorial Award**

Established by the family and friends in memory of Mark Latham (B.Sc. '83), a Queen's Engineering Chemist. The purpose of this award is to recognize a student with personal characteristics similar to those of Mark Latham. The purpose of this award is to recognize students with personal characteristics similar to those Mark Latham. It will be awarded to students in good academic standing entering the fourth year of the Faculty of Engineering and Applied Science. The recipients will be well rounded students combining enthusiasm and leadership with integrity and a sense of humour. Candidates for this award will have made significant contributions to Queen's and the community. Selection shall be made by the Operations Committee (Scholarships) of Engineering and Applied Science based on nominations provided by the Engineering Society.

## **Reuben Wells Leonard Penultimate Scholarships**

Given by Reuben Wells Leonard for standing on year's work in any program in engineering. A minimum average of 80 percent is required.

## **Michele Mainland Memorial Scholarship in Chemical Engineering**

Details of this scholarship are given in the section on *Second Year Awards*.

## **Kogi Lon Mayell Memorial Scholarship**

Established in memory of Kogi Lon Mayell, B.Sc.'91, by his family and friends and awarded on the basis of academic performance to a student entering the final year of the Mechanical Engineering program. The recipient should also be involved in student affairs, sports, and other extracurricular activities and show a willingness to assist fellow students. The selection of the candidate will be made by the Head of Mechanical Engineering in consultation with members of the Department.

## **Roberta McCulloch Prize in English**

Details of this scholarship are given in the section on *Second Year Awards*.

## **McLean Family Award in Student Design**

Details of this award are given in the section on *Second Year Awards*.

## **Edward Hugh McLellan Memorial Scholarship in Soil Mechanics**

Established in memory of Edward Hugh McLellan, Sc.'80. Awarded annually to the Civil Engineering student with the highest standing in CIVL 340.

## **Andrew McMahon Standards of Excellence Award**

Established in memory of Andrew M. McMahon Sc. '59, a former president of the Engineering Society and member of the Board of Trustees. Awarded annually in Engineering and Applied Science on the basis of academic achievement to a third year student in the top 25% of the class who is entering fourth year. Preference will be given to students who have demonstrated an interest in business studies or economics. The recipient will show a strong record of participation in student organizations and government, extra curricular and community activities and interest in promoting the well-being of the University. The recipient will be chosen by a Selection Committee, to be chaired by a member of the family, consisting of the Associate Dean (Academic), one member of the business community and a family member. Candidates should submit a letter of application and supporting documents to the Faculty of Engineering and Applied Science by 31 March.

## **Mining Engineering Scholarship**

Established in May 2007 by Bill James, LL.D 1990, and awarded on the basis of academic excellence and demonstrated leadership qualities to a student entering the fourth year of the Mining Engineering program in the Faculty of Engineering and Applied Science. Students should apply by letter, with a resume, to the Buchan Department of Mining by 31 March.

## **Mining 1988 Scholarship**

Details of this award are given in the section on *Second Year Awards*.

## **R.T. Mohan Undergraduate Scholarship in Chemistry**

Details of this award are given in the section on *Second Year Awards*.

## **Modular Mining Systems Scholarships**

Details of this award are given in the section on *Second Year Awards*.

## **Susan Near Scholarships**

Established under terms of the will of Susan Near of Toronto, for standing on year's work. (5 available)

## **Susan Near Prizes in Chemistry**

Founded by the late Susan Near of Toronto. Two prizes to be awarded, one to the student in Arts and Science with the highest standing in CHEM 397, and one to the student in Applied Science with the highest standing in CHEM 398 or CHEM 399, provided the mark obtained in each case is at least 80 per cent.

## **William Wallace Near Scholarships**

Established under the terms of the will of W.W. Near of Toronto, for standing on year's work; one awarded to a student in each of the following programs: Engineering Chemistry, Chemical Engineering and Civil Engineering.

## **P.E. Newbury Prize in Geological Sciences and Geological Engineering**

Established by the late Mrs. Peggy Ethel Newbury. Awarded in the Fall on the recommendation of the Department of Geological Sciences and Geological Engineering for outstanding achievement in geological field work, with at least second class standing in the previous year's academic work.

### **Northeastern Chemical Association Scholarship**

Details of this award are given in the section on *Second Year Awards*.

### **Novelis Scholarship**

Details of this award are given in the section on *Second Year Awards*.

### **Ontario Professional Engineers Foundation for Education**

Details of this award are given in the section on *First Year Awards*.

### **David Parkes Scholarship in Applied Science**

Details of this award are given in the section *Second Year Awards*.

### **Christopher Petrie Memorial Prize in Physics**

Awarded to a student in either Engineering and Applied Science or Arts and Science who has obtained a first class standing in a third year laboratory course in experimental physics and who, in the opinion of the department, shows the most promise of future achievement in experimental physics.

### **Mark Pettit Memorial Prize**

Established in April 2002 by friends and family in memory of Mark Pettit, B.Sc. (Mechanical Eng.) 2000. Awarded annually to a student in the third year of the Mechanical Engineering program in the Faculty of Engineering and Applied Science who has applied and been accepted into the Queen's Undergraduate Internship Program (QUIP). The candidate should demonstrate an enthusiasm for engineering and a proven record of helping his/her classmates, as well as a solid academic record. Nomination forms are available from the Department of Mechanical Engineering and must be submitted to the Department by 15 April. Selection of the candidate is made by the Head of the Department of Mechanical Engineering in consultation with faculty and students.

### **Frank S. Pichler Memorial Scholarship**

Details of this award are given in the section *Second Year Awards*.

### **Polycorp Ltd./Kumar Scholarship in Mining Engineering**

Details of this award are given in the section on *First Year Awards*.

### **W.T. Pound Engineering Design Award**

In memory of William Thomas Pound, who graduated from Queen's University in Mechanical Engineering in 1929. Awarded to a third year student upon completion of MECH 323 Machine Design. The award is directed to the

individual who has demonstrated an exceptional understanding of machine design principles, and an outstanding aptitude for creative and innovative design. The selection of the candidate will be made by the Head of the Department in consultation with the course instructors.

### **Queen's C.A.P. Prize Examination Award**

Details of this award are given in the section on *Second Year Awards*.

### **QUIP International Tuition Award**

Established in November 2007 by the Faculty of Engineering and Applied Science and awarded on the basis of academic achievement to international students participating in the Queen's University Internship Program (QUIP).

**Value: variable on the basis of available funding and duration of internship.**

### **James H. Rattray Memorial Scholarships in Applied Science**

Details of this award are given in the section on *First Year Awards*.

### **Major James H. Rattray, M.C. Prize in Mining**

Founded by Major J.H. Rattray, M.C., for general proficiency in Mining. Aptitude as well as academic standing to be taken into account in making the award.

### **Carl Reinhardt Scholarship in Physics**

To be awarded annually on the basis of standing at the end of the third year to a student registered in the fourth year of a B.Sc. program in engineering physics or an honours B.Sc. program with concentration in physics who does not already hold an award of higher approximate value.

### **Rock Mechanics Achievement Scholarship**

Established in January 2012 by James F. Archibald and the Rock Mechanics Group of the Robert M. Buchan Department of Mining. Awarded on the basis of academic excellence in the third year course in Applied Rock Mechanics to a student entering the fourth year in Mining Engineering in the Robert M. Buchan Department of Mining. Selection will be made by the Faculty of Engineering and Applied Science Operations Committee (Scholarships).

### **Alvin Craig Ross Memorial Scholarships in Mineral Processing**

Details of these awards are given in the section on *Second Year Awards*.

### **Science 1944 Memorial Prize**

Maintained by the class of Science '44 in memory of members who were killed in World War II. Awarded on basis of extra-curricular student activities. Candidates must have passed all work of year.

### **A.E. Segsworth Prize**

Details of this award are given in the section on *Second Year Awards*.

## **Raymond H. and Phyllis J. Smart Scholarships**

Details of this award are given in the section on *First Year Awards*.

## **Carolyn F. Small Memorial Award for Design Innovation**

Details of this award are given in the section on *Second Year Awards*>

## **Robert E. Smith Memorial Scholarship in Mining Engineering**

Details of this award are given in the section on *Second Year Awards*.

## **Roberto Rocca/Tenaris Scholarships**

Established in April 2010 by Tenaris and the Roberto Rocca Education Program. The scholarships reflect the long-standing commitment of the late Roberto Rocca and Tenaris to supporting education at all levels in countries where the sponsoring companies have a major presence. Throughout his lifetime Roberto Rocca demonstrated an abiding concern for education, founding and supporting a variety of initiatives dedicated to learning at all levels and research. Awarded on the basis of academic excellence to students entering their final year in the Faculty of Engineering and Applied Science. Preference will be given in the following order of priority: (a) female students from Northern Ontario or Alberta; (b) students from Northern Ontario or Alberta; (c) female students. Selection will be made by the Operations Committee (Scholarships) of the Faculty of Engineering and Applied Science. **3 awards**

## **Walter Thumm Memorial Scholarship in Physics**

Established by his family and friends in memory of Walter Thumm, Professor at Queen's until his death in 1977. By his understanding and enjoyment of physics, by his writing and by his own example, he inspired countless students and teachers of physics. Awarded on the recommendation of the Physics Department to a student beyond the second year who has indicated his/her intention of pursuing a career in teaching physics, preferably at the high school level, and who has a strong aptitude in physics as well as a demonstrated commitment to teaching.

## **Howard Vance Memorial Book Prize**

Established in memory of Howard Vance, B.Sc. '70. Awarded annually to the Civil Engineering student proceeding to the final year who, in the opinion of the Department of Civil Engineering, has made the greatest improvement in his/her academic work from second to third year.

## **WAMIC Scholarship**

Established in October 2010 by the Women's Association of the Mining Industry of Canada Foundation and awarded on the basis of academic excellence to students entering year four in the Robert M. Buchan Department of Mining or the Geological Engineering program in the Department of Geological Sciences and Geological Engineering. Selection will be made by the Faculty of Engineering and Applied Science Operations Committee (Scholarships).

## **William E. White Scholarships in Geological Sciences and Geological Engineering**

Details of these awards are given in section on *Second Year Awards*.

## **Martin Wolff Memorial Prize**

Established by Dr. A.R. Bader in memory of Martin Wolff, for standing on year's work. Open to candidates in Civil Engineering.

## **Fourth Year Awards**

### **L.M. Arkley Prize**

Founded by the Scots Run Fuel Corporation of Morgantown, W.Va., in recognition of Professor Arkley's interest in the proper methods of purchasing, analyzing and burning coal. Awarded to a fourth year Mechanical Engineering student or group of students who submits the best paper, supported by an oral presentation, on a subject of the students' choice and with the approval of the Mechanical Engineering Department. Selection will be made by the Department of Mechanical Engineering by 31 March.

### **Alfred Bader Scholarship in Chemistry**

Established by A.R. Bader, M.Sc. (Queen's), Ph.D. (Harvard). Awarded to a student in Arts and Science or in Engineering and Applied Science who has registered in the fourth year and obtained the highest Grade Point Average in Chemistry 311 or Chemistry 345.

### **Orville and Carmel Brown Scholarship**

Details of this award are given in the section on Second Year Awards.

### **Harold M. Cave Undergraduate Travel Scholarship**

Details of this award are given in the section on *Second Year Awards*.

### **George Christie Design Awards**

Established by J.G. Parrett, B.Sc.'89 and W.R. Sherwin, B.Sc.'89 in memory of the late George Christie. The awards are presented to individual students or groups of students in Mechanical Engineering on the basis of their performance in the area of design and product modification in their fourth year Mechanical Engineering Design Project. The selection of award winners will be made by the Department.

### **Civil 1985 Award**

Awarded annually to a 4th year student in Civil Engineering who has contributed to the betterment of campus life through interest in the Engineering Society, Civil Club, campus activities and community affairs. The successful candidate must have maintained a satisfactory academic record. Applications and nominations should be submitted to the Head of the Civil Engineering Department by 31 January.

### **Charles W. Drury Scholarship in Mechanical Engineering**

Details of these awards are given in the section on *Third Year Awards*.

### **Dynatec Corporation Prize in Mining Engineering**

Awarded for combined standing in courses MINE 225 and MINE 444. Details of these awards are given in section on *Fourth Year Awards*.

### **Willard G. Henry Memorial Scholarship**

Established by the family, friends, colleagues and students of the late Dr. Willard Geldard Henry, Professor of Metallurgical Engineering 1962-1981, Head of Department 1977-1981, as a tribute to his outstanding contribution to metallurgical science, his excellence as a teacher and above all, his concern for his fellow man. The scholarship is awarded in the fall on the recommendation of the Head of the Department of Mechanical and Materials Engineering, following consultation with departmental colleagues and students, to a student registered in the fourth year of the Materials Option in the Mechanical Engineering program on the basis of the scholarship, character, industry and contribution to furthering the well-being of the student body. On occasion the scholarship may be given to an exceptional student registered in the third year of the above program.

### **Shirley C. Kennedy Scholarship in Civil Engineering**

Details of this award are given in the section on *Second Year Awards*.

### **Joan M. Lund Memorial Award**

Established by the family and friends of Joan M. Lund, a geophysics student in the Department of Geological Sciences at the time of her death. Awarded in the Fall term in the fourth year of either the Applied Geophysics option, Faculty of Engineering and Applied Science, or the B.Sc. (Honours, Geological Sciences) with Physics program, Faculty of Arts and Science to the student who has contributed most to the geophysics program in the previous years. The recipient will be decided by the Chairpersons of the Engineering and Applied Science and Arts and Science Curriculum and Liaison committees in consultation with the student members of those committees.

### **Dr. W.B.F. Mackay Memorial Scholarship in Mechanical and Materials Engineering**

Established in May 2007 by family, friends, colleagues and students of the late Dr. William Brydon Fraser Mackay, HD.Sc (1993). Awarded to a student in the fourth year of the Materials Option in the Department of Mechanical and Materials Engineering on the basis of academic excellence and contributions to furthering the well-being of the student body by way of active participation in volunteer activities, project teams, and professional and social activities within the Department. Application is by letter, with resume, to be submitted to the Department of Mechanical and Materials Engineering by 1 October.

### **Roberta McCulloch Prize in English**

Details of this scholarship are given in the section on *Second Year Awards*.

### **McLean Family Award in Student Design**

Details of this award are given in the section on *Second Year Awards*.

### **Novelis Scholarship**

Details of this award are given in the section on *Second Year Awards*.



## **David Parkes Scholarship in Applied Science**

Details of this award are given in the section on *Second Year Awards*.

## **Polycorp Ltd./Kumar Scholarship in Mining Engineering**

Details of this award are given in the section on *First Year Awards*.

## **Queen's C.A.P. Prize Examination Award**

Details of this award are given in the section *Second Year Awards*.

## **Science 1971 Norman Fritz Memorial Award**

Awarded annually to a fourth year student of the Faculty of Engineering and Applied Science who displays conspicuous leadership and management skill in a student-organized faculty activity which has educational value. An example of such an activity might be that of Convenor of the Science Forum. The recipient of the award is to be selected by the Dean of Engineering and Applied Science and the presentation will be made during the first quarter of each calendar year.

## **A.E. Segsworth Prize**

Details of this award are given in the section on *Second Year Awards*.

## **Carolyn F. Small Memorial Award for Design Innovation**

Details of this award are given in the section on *Second Year Awards*.

## **William E. White Scholarships in Geological Sciences and Geological Engineering**

Details of these awards are given in the section on *Second Year Awards*.

## **Graduation Awards**

### **Applied Rock Mechanics Scholarship**

Established in January 2012 by Jamie Archibald and the Rock Mechanics Group of the Robert M. Buchan Department of Mining to honour those in the mining industry who strive to augment rock mechanics training and enhance the safety of all who participate in this industry. Awarded on the basis of academic excellence to a student in the fourth year thesis course in the Robert M. Buchan Department of Mining, who has submitted a thesis that relates to practical applications of rock mechanics principles in mining, or to the development of fundamental applications of rock mechanics practice that may advance studies of enhanced mine safety. Selection will be made by the Faculty of Engineering and Applied Science Operations Committee (Scholarships).

### **Alan Bauer Memorial Prize in Mining Engineering**

Established by friends, colleagues and students of Alan Bauer, former Head of the Department of Mining Engineering, as a tribute to his outstanding contributions in teaching and research to the department. Awarded on the

recommendation of the Head of the Department to fourth year graduating students in Mining Engineering at Queen's. Two awards will be made annually for the thesis presentation component of course MINE 434. Awards will be presented on the basis of technical content and presentation skills.

### **Colin T. Bayne Memorial Award**

Founded by the Class of Mechanical Engineering '76 and friends in memory of Colin Thomas Watson Bayne, B.Sc. '76. Awarded to the graduating Mechanical Engineering student who, in the opinion of the Department, has shown most proficiency in innovative design.

### **Diana Blake Memorial Book Prize**

A memorial book prize established by the Alumni and Alumnae Associations of Queen's in memory of the late Diana Blake, who was Assistant Chief Librarian at Queen's and Vice-President of the Alumni Association at the time of her death in February, 1975. Awarded annually in turn to a graduating student in the Faculty of Arts and Science, the Faculty of Engineering and Applied Science, and the School of Business. The appropriate Society will be asked to nominate a student who has attained at least second class standing and who has made a significant contribution to campus life prior to 1 March of the graduating year. Nominations will be received and selection of the recipient will be made by the appropriate Faculty Awards Committee.

### **Dr. Wallace Graham Breck Memorial Prize in Engineering Chemistry**

Established by the family of Dr. Wallace Graham Breck, Sc. 50, M.Sc. 51, PhD (Cantab University), and awarded annually to the graduating student who is the recipient of the University Medal in Engineering Chemistry in the Faculty of Engineering and Applied Science. Selection will be made by the Awards Committee of the Department of Chemical Engineering and approved by the Faculty of Engineering and Applied Science Operations Committee (Scholarships).

### **H.G. Conn Award**

Named in honour of Professor H.G. Conn, who has contributed much to Queen's University. It is awarded to graduating students who have rendered valuable and distinguished service to the Engineering Society and the University in non-athletic, extra-curricular activities.

### **Conn-Gilbert Award for Excellence in Engineering**

To be awarded to a Mechanical Engineering student, in the year in which the student graduates, who has the highest average on the core courses in Thermodynamics.

### **CSME Gold Medal**

Awarded by the Canadian Society for Mechanical Engineering to the student graduating in Mechanical Engineering who has achieved the highest overall cumulative average in 2nd, 3rd and 4th years.

### **H.M. Edwards Memorial Award**

Established by his family in memory of the late H.M. (Bert) Edwards, B.Sc. '44, MSCE (Purdue), faculty member in Civil Engineering 1946-1985, as a tribute to his outstanding contribution to the Civil Engineering Department and the Faculty. Awarded annually to the graduating student in Civil Engineering who, in the opinion of the Head of the

Department and the Civil Engineering Scholarship Committee, has demonstrated notable proficiency in all fourth year courses.

### **Dynatec Corporation Prize**

Details of this award are given in the section *Fourth Year Awards*.

### **D.S. Ellis Memorial Award**

Given by the class of Science '55 as a memorial to Dean D.S. Ellis. Awarded to graduating student who, in the opinion of classmates, has contributed to the University life through extra-curricular activities and athletics and has maintained satisfactory academic standing.

### **Engineering Society Award**

Awarded by the Engineering Society to honour a student in the fourth year who is not a member of the Engineering Society Executive and who has contributed considerably to the welfare of the Engineering Society.

### **Engineering Physics Design Award**

Awarded to the graduating student in Engineering Physics whose Engineering Physics thesis is judged, by the examiners, to be the best on the basis of design, engineering content, innovation and presentation.

### **D.M. Jemmett Award**

Awarded to a student graduating from the Electrical and Computer Engineering Department who has achieved the highest average in Electrical Engineering courses of all years. Average is based on marks of final examinations and not on results of any repeated courses.

### **B.E.C. Joyce Memorial Award**

Awarded to student graduating in Chemical Engineering who, in the opinion of classmates and department staff, is the outstanding graduate in Chemical Engineering.

### **Shirley C. Kennedy Scholarship in Civil Engineering**

Details of this award are given in the section *Second Year Awards*.

### **Thomas F. LaPierre Award**

Awarded annually to a student graduating from the Electrical and Computer Engineering Department who has achieved the highest honours standing in the program.

### **S.D. Lash Scholarship**

Awarded to a graduating student in the Department of Civil Engineering to encourage travel during the summer preceding the start of a graduate program at any University, in order to give the recipient an appreciation of practical problems in their field of interest. Application is by letter, describing the studies they wish to pursue and the places they

would like to visit, to be submitted to the Department of Civil Engineering by March 31. Selection will be made by the Departmental Scholarship Committee.

### **Boyd Lemna Award**

Established by Science '92 in honour of their classmate Boyd Lemna. Awarded annually by the Engineering Society to a mature graduating student(s) who has completed an engineering degree in four years. Preference will be given to students who are parents.

### **Annie Bentley Lillie Prize in Mathematics**

Awarded to graduating student in program in Mathematics and Engineering who has highest average on courses in Mathematics in final year.

### **Thayer Lindsley Book Prize**

Established in memory of Thayer Lindsley and awarded to the graduating student in Geological Engineering in the Faculty of Applied Science, or Geological Sciences in the Faculty of Arts and Science, who has contributed the most to his or her year as judged by staff and students in the Department of Geological Sciences and Geological Engineering.

### **Michele Mainland Memorial Graduating Scholarship in Chemical Engineering**

Established in memory of Michele Mainland, B.Sc. '97, by family, friends, and fellow students to honour Michele's love of learning and education. Awarded to a student graduating in Chemical Engineering with the highest academic standing and who is continuing to post-graduate studies either at Queen's or at another institution. Candidates should submit a letter of application to the Head of the Department by 1 April detailing their intended course of study. The recipient will receive the award in the Fall Term on confirmation of registration in graduate school.

### **Michele Mainland Memorial Medal in Chemical Engineering**

Established in memory of Michele Mainland by family, friends and fellow students in recognition of Michele's efforts and courage. Awarded to a graduating Chemical Engineering student who, in the opinion of classmates and department staff, best exemplifies Michele's personal qualities: persistence and cheerfulness in the face of adversity, sense of adventure, tenacity, courage and helpfulness to others.

### **C.W. Marshall Memorial Award**

Awarded annually to graduating student in Civil Engineering who, in opinion of the instructors, has demonstrated notable proficiency in field of structural engineering during third and fourth years and whose academic proficiency has not been identified by a General Proficiency Medal or other distinctive honour.

### **J.D. McCowan Prize in Integrated Learning**

Established by colleagues and friends in recognition of the contribution made by Dr. James D. McCowan to the Integrated Learning Initiative in the Faculty of Engineering and Applied Science. Awarded to a graduating student or graduating members of a student team that have made a significant contribution to the Integrated Learning Initiative during their time in the Faculty of Engineering and Applied Science. Selection will be made by the Engineering and Applied Science Operations Committee (Scholarships).

### **F.K. McKean, Science 1940, Prize in Mining Engineering**

Established by the McKean family in memory of Fleetwood K. McKean, Science '40. Awarded to the student in Mining Engineering who best demonstrates good written communication in the final year thesis. Selection will be made by the Department of Mining Engineering by 31 March.

### **The Edward Hugh McLellan Memorial Scholarship in Coastal Geotechniques**

Established in memory of Edward Hugh McLellan, Sc. '80. Awarded annually to the Civil Engineering student with the highest aggregate standing in CIVL 342 and CIVL 456.

### **Glen Chandler Milbourne Memorial Scholarship**

The Glen Chandler Milbourne Memorial Scholarship has been established by his family, friends and colleagues to perpetuate the values Glen demonstrated during his time at Queen's. The scholarship is awarded on the basis of academic performance to a student graduating from the Materials Option in Mechanical Engineering, who best exemplifies Glen's interpersonal and communication skills, his dedication to teamwork and sportsmanship and his interest and proficiency in the metallurgical profession. In the case of students being equally eligible, preference will be given to a student who is continuing to graduate studies in the Materials and Metallurgical program at Queen's. The selection is made by the Head of the Department in consultation with faculty and students.

### **L.A. Munro Award in Engineering Chemistry**

Established by Professor L.A. Munro, who for many years was a member of the Department of Chemistry at Queen's. The award is presented annually for general proficiency to a graduating student of the Engineering Chemistry program.

### **O'Connor Associates Award in Geotechnical Engineering**

Awarded annually on the recommendation of the Head of the Department of Civil Engineering, in consultation with geotechnical engineering instructors, to a graduating student in Civil Engineering or Geological Engineering (Geotechnical Option) who has demonstrated notable proficiency in the area of geotechnical engineering.

### **Ontario Professional Engineers Foundation for Education Medal for Academic Achievement**

Given by the Ontario Professional Engineers Foundation of Education, and awarded to the student with highest academic standing in the final year. Selection will be made the Engineering and Applied Science Operations Committee (Scholarships).

### **Paithouski Prize**

Established in memory of Nicholas J. Paithouski (B.Sc. '40) by his son N. Joseph Paithouski (B.Sc. '80) and friends and awarded to the graduating engineering student who has demonstrated the most consistent improvement in academic performance. The cumulative annual point spread in sessional average over the most recent eight terms will be used as a basis for determining the winner. Selection will be made by the Engineering and Applied Science Operations Committee (Scholarships).

### **L.J. Patterson Prize in Mine Management**

Founded by Lewis J. Patterson, retired President of Quebec Cartier Mining Company, who taught management within the Mining Engineering Department for 10 years. Awarded, on the recommendation of the Head of the Department, to a student graduating in Mining Engineering who has obtained the highest combined standing in fourth year mine management courses.

### **Queen's C.A.P. Prize Examination Award**

Details of this award are given in the section *Second Year Awards*.

### **Carolyn F. Small Memorial Award for Design Innovation**

Details of this award are given in the section *Second Year Awards*.

### **E.T. Sterne Prize**

Founded by Dr. E.T. Sterne and awarded annually to student graduating in Chemical Engineering who has highest aggregate standing in Chemical Engineering subjects taken throughout undergraduate years.

### **J.B. Stirling Gold Medal in Applied Science**

Awarded annually to a student of the graduating class who has made the highest standing throughout the four year program. A student who has failed a year is not eligible. Selection will be made by the Engineering and Applied Science Operations Committee (Scholarships).

### **Society of Chemical Industry Student Merit Award**

Established by the Canadian Section of the Society of Chemical Industry to encourage scientific education in the universities and to recognize student achievement in scientific fields. Awards are given to the students with the highest standing in the final year in each of the four fields of chemical engineering, engineering chemistry, honours chemistry, and honours biochemistry, provided that they have first-class averages and have completed their program in the normal number of years. The award is a plaque bearing the crest of the Society of Chemical Industry and the winner's name, program, University and year.

### **M. Sullivan and Son Limited Scholarship**

Established in December 2005 by the Sullivan family and awarded to a graduating student in Chemical Engineering or Engineering Chemistry in the Faculty of Engineering and Applied Science or Chemistry in the Faculty of Arts and Science on the basis of outstanding achievement for a research project in Chemistry. Selection will be made by the Departmental Awards Committee and approved by the Awards Committee of the Faculty of Engineering and Applied Science and the Faculty of Arts and Science.

### **Walter Thumm Memorial Scholarship in Physics**

Details of this award are given in the section on *Third Year Awards*.

### **University Medals**

May be awarded annually in each department to student of the graduating class who has highest average in all courses of third and fourth years, provided average is 80 percent or higher.

## **Peter R. White Memorial Award**

Given as a memorial to Peter R. White by his friends and awarded to graduating student in Engineering and Applied Science who has made the most outstanding contribution to the creative arts and the development of inter-personal relations both on and off campus. Nominations will be submitted by the Engineering Society to the Engineering and Applied Science Operations Committee (Scholarships).

## **E.B. Wilson Memorial Prize in Mining Engineering**

Established by family, friends, colleagues and students of the late Edward B. Wilson, Professor of Mining Engineering 1964-1983, as a tribute to his outstanding contribution to the Mining Department and excellence as a teacher. Awarded annually on the recommendation of the Head of the Department to the fourth year Mining Engineering student producing the highest rated undergraduate thesis on a topic involving operations research or computer applications in Mining.

## **Zurbrigg Memorial Scholarship**

Established by H.F. Zurbrigg, Science '31, in memory of his parents and awarded to a Canadian graduate of the Faculty of Engineering and Applied Science who is continuing at Queen's either as a post-graduate in any faculty or as an undergraduate in the faculties of Law or Medicine. The award is made on the basis of scholarship and proficiency in the use of the English language. Applicants must submit by 31 March a letter to the Chair of the Engineering and Applied Science Scholarships Committee detailing their background and career objectives. The recipient will receive the award in the Fall Term on confirmation of registration.