



# School of Engineering

## 2009-2010 PROGRAM GUIDE Bachelor of Engineering (B.Eng.) University of Guelph

### Follow YOUR Program Guide

The School of Engineering Program Guide is required reading material for students registered in the B.Eng. Program.

All students accepted into the B.Eng. Program for Fall 2009 or Winter 2010 must follow the **Schedule of Studies** for their registered program as outlined in the **2009-2010 Undergraduate Calendar** and **this Program Guide** throughout their entire engineering program. The best way to plan ahead and keep track of your course requirements is to follow your Program Guide. Students are not permitted to mix and match courses with program guides from previous or subsequent calendar years. Students should also verify with other departments and course instructors, as required, to ensure that courses listed herein continue to be offered and are not cancelled or rescheduled.

The University reserves the right to change without notice any information contained in this Program Guide, including regulations for admission, continuation of study, course offerings and provision of facilities. Any curriculum changes or academic announcements that may affect or alter the information found in this Program Guide will normally be sent to you via your uoguelph email account and/or posted on the School of Engineering (SOE) website: <http://www.soe.uoguelph.ca>.

Students should refer to the **current** Undergraduate Calendar for important deadlines, rules and regulations, procedures for academic consideration and appeals, and continuation of study requirements: <http://www.uoguelph.ca/registrar/calendars/undergraduate/current/>.

### Student responsibilities

In addition to the student responsibilities published in Section I of the Undergraduate Calendar:

- It is the responsibility of each student to **use** their uoguelph email account for all university correspondence. Yahoo, gmail, hotmail, etc. are not acceptable.
- It is the responsibility of each student to **maintain** their uoguelph email account and to **read** all official university correspondence.
- It is the responsibility of each student to **read** and **understand** all academic rules, regulations, procedures and important deadlines as printed in the current Undergraduate Calendar. If a student is still unsure of their responsibilities after reading the information provided in the Undergraduate Calendar or require further clarification, they should contact their Program Counsellor.

***Do not rely on rumours to navigate your way through your program!!!***

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## PROFESSIONALISM

### Accreditation and Becoming a Professional Engineer

In Canada, “Engineer” and “Professional Engineer” are titles restricted by law to those people who have demonstrated their competence and have been licensed in a provincial or territorial Association of Professional Engineers (in Quebec, Ordre des ingenieurs du Quebec). To practice engineering in Canada, it is mandatory to have earned the Professional Engineer (P.Eng.) designation by registering with your provincial or territorial association.

The Canadian Engineering Accreditation Board (CEAB) is a standing committee of Engineers Canada that is responsible for accrediting Canadian undergraduate engineering programs that meet or exceed educational standards for professional engineering registration in Canada. All B.Eng. degree programs at the University of Guelph are accredited by the CEAB. As a graduate from a Canadian accredited undergraduate engineering program, you will be eligible to register as a member of the Professional Engineering Association in the province where you live and work. Requirements for post-graduation experience may vary from province to province.

In Ontario, the Professional Engineers Ontario (PEO) requires four years of acceptable engineering experience upon graduation and successful completion of the Professional Practice Exam on engineering law and ethics. You may apply for your Professional Engineer (P.Eng.) license immediately after graduation or any time thereafter. Most students arrange to write the Professional Practice Exam soon after graduation while the material is still fresh in their minds.

Applicants can also earn up to 12 months work experience during the completion of their engineering degree through co-operative education or summer employment. The quality of the pre-graduation work experience will be measured against five quality-based criteria. Only pre-graduation work experience acquired after the mid-point of your undergraduate program is eligible for credit. It is strongly recommended that letters of reference be obtained from a professional engineer who is familiar with your work experience before you return to school after a coop work term or summer employment. These letters may be difficult to obtain if you wait until after graduation. Be sure the letter contains the reference’s contact information for follow-up by the PEO.

To facilitate a better understanding of the PEO, a Student Membership Program (SMP) for undergraduate students has been initiated by the School of Engineering at the University of Guelph. The School of Engineering encourages all students become SMP members. This membership is provided free of charge by PEO. For more information about becoming a PEO student member, please contact the Engineering Society (EngSoc) at extension 58549, Dr. Richard G. Zytner, P.Eng., (rzytner@uoguelph.ca), or log onto: [www.engineeringstudents.peo.on.ca](http://www.engineeringstudents.peo.on.ca).

Students are encouraged to contact the PEO regarding information about P.Eng. licensing procedures, writing the Professional Practice Exam, or pre-graduation work experience.

#### **Professional Engineers Ontario**

1000-25 Sheppard Ave. W.

Toronto, Ontario

M2N 6S9

Phone: (416) 224-1100

Toll free: 1 (800) 339-3716

Fax: (416) 224-8168

Website: [www.peo.on.ca](http://www.peo.on.ca)

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## School of Engineering Code of Ethics

The School of Engineering has adopted the Engineering Code of Ethics. Please refer to the School of Engineering Website for more information <http://www.soe.uoguelph.ca/academic/pages/home.html>.

Failure to follow the Code of Ethics will initiate a review of the offence according to the University of Guelph's Academic Misconduct Policy as described in the current Undergraduate Calendar. This includes any other academic misconduct offence as outlined under Academic Misconduct in the Undergraduate Calendar.

## Blue Pages

Once the academic misconduct process has run its course and an occurrence of academic misconduct has been confirmed, the details (without naming the student or the course involved) will be published in the School of Engineering's Blue Pages as is done in the PEO Dimensions regular publication. <http://www.soe.uoguelph.ca/academic/pages/home.html>.

## Academic Misconduct

As per the definition published in Section VIII, Undergraduate Degree Regulations and Procedures of the Undergraduate Calendar, "Academic misconduct is behaviour that erodes the basis of mutual trust on which scholarly exchanges commonly rest, undermines the University's exercise of its responsibility to evaluate students' academic achievements, or restricts the University's ability to accomplish its learning objectives.

The University takes a serious view of academic misconduct and will severely penalize students, faculty and staff who are found guilty of offences associated with misappropriation of others' work, misrepresentation of personal performance and fraud, improper access to scholarly resources, and obstructing others in pursuit of their academic endeavours. In addition to this policy, the University has adopted a number of policies that govern such offences, including the policies on Misconduct in Research and Scholarship and the Student Rights and Responsibilities regulations. These policies will be strictly enforced.

It is the responsibility of the University, its faculty, students and staff to be aware of what constitutes academic misconduct and to do as much as possible through establishment and use of policies and preventive procedures to limit the likelihood of offences occurring. Furthermore, individual members of the University community have the specific responsibility of initiating appropriate action in all instances where academic misconduct is believed to have taken place. This responsibility includes reporting such offences when they occur and making one's disapproval of such behaviour obvious.

University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students should also be aware that if they find their academic performance affected by medical, psychological or compassionate circumstances, they should inform the appropriate individuals (instructors, program counsellors, graduate advisors) and follow the available procedures for academic consideration outlined in the University's calendars."

### *Offences*

Please refer to the current Undergraduate Calendar, Section VIII, Undergraduate Degree Regulations and Procedures – Academic Misconduct – Offences for a definition of academic misconduct offences

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## *Penalties*

In accordance with the Undergraduate Calendar, Section VIII, Undergraduate Degree Regulations and Procedures – Academic Misconduct – Penalties, if a student is found guilty of academic misconduct, one or more of the following penalties may be applied:

1. A requirement for submission of a new or alternative piece of work.
2. The rescinding of University-funded scholarships or bursaries.
3. Partial or total loss of marks on the examination or assignment in which the offence occurred.
4. Partial or total loss of marks for the course in which the offence occurred.
5. Suspension from the University for a period of between one and six consecutive semesters. For the period of suspension, a student will not be permitted to register and will retain none of the privileges accorded to students with respect to right of access to University faculty, staff, facilities or services.
6. A recommendation for expulsion from the University.
7. A recommendation for revocation/rescinding of a degree. A person who is found guilty of academic misconduct after having been approved for graduation, or after having a degree conferred, may have the degree rescinded or revoked when, in the opinion of the dean, the offence, if detected, would have resulted in a sanction sufficiently severe that the degree would not have been granted at the time that it was.

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## PROGRAM INFORMATION

### Admission Requirements

The following Ontario Grade 12 secondary school credits are required for application to the B.Eng. program.

English (ENG4U)

Advanced Functions (MHF4U)

Calculus (MCV4U)

2 credits from: Biology (SBI4U), Chemistry (SCH4U) or Physics (SPH4U)

1 additional 4U or 4M credit

Specific secondary school admission requirements for applicants from other provinces, transfer students and international students can be found in Section IV Admission Information in the Undergraduate Calendar or on the Admission Services Website:

<https://admission.uoguelph.ca/Home.aspx?SiteID=ded7a702-26e3-4bd1-a69d-da4ea7ee21f3>

Grade 12 Physics and Chemistry are strongly recommended. Applicants who lack one of these credits will be required to take a replacement credit in Semester 1. The credit placed on the university transcript for these Grade 12 equivalent courses will not count toward the B.Eng. degree requirements. Please speak with the Engineering Program Counsellor as soon as possible if you are missing any of the entrance requirements.

### Transfer Students

Many students transfer into the B.Eng. Program from other universities and colleges. Most transfer students enter the program with advanced standing (credit transfers or exemptions). The time required to complete your Engineering degree will depend on your outstanding course requirements, course availability (i.e. fall, winter, spring course offerings) and potential course timetable conflicts.

You should consult the Engineering Program Counsellor for an explanation of your credit transfers and conditions of admission and for help in selecting courses. Requests for credit transfers in addition to those included in your offer of admission must be made by the end of your first semester in the B.Eng. Program. Forms to request additional credit transfers are available from the Engineering Program Counsellor.

### International Exchange Programs

Engineering students are encouraged to investigate the many opportunities offered by the Centre for International Programs (CIP). Studying in another country provides a cultural experience that can be highly beneficial not only for personal development, but also for professional development. The University of Guelph has international exchange agreements with over 65 institutions around the world, with more than 25 offering engineering programs. Many of Guelph's non-English university partners teach courses in English. This includes the National University of Singapore (NUS), one of the top ten universities in the world, which offers an engineering program recognized worldwide for its innovation and international perspective. In recent years, engineering students from Guelph have attended the University of Lund in Sweden and the University of Adelaide in Australia.

Engineering students can also take advantage of University of Guelph's Semester Abroad Programs in Krakow, India and London, Paris, and Guatemala. Semester Abroad programs involve up to 25 Guelph students traveling overseas with a Guelph professor for a semester, with courses taught in English by on-site faculty. For more information on exchange and Semester Abroad programs please visit:

<http://www.uoguelph.ca/cip/> or drop by CIP on the 3<sup>rd</sup> floor of the University Centre.

Students interested in participating in an international program should be aware that not all courses required for their engineering degree program can be taken abroad. The decision to study abroad often results in

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additional time required to complete your degree. However, many believe the experience far outweighs the time commitment. If you plan early enough, it may be possible to still finish your degree in eight semesters. Applications for exchange are completed entirely online. To gain access to the online application, you must first sign up for and attend an information session at the CIP.

Students are encouraged to consult with the CIP to investigate exchange program opportunities and to discuss their course sequencing with their program counsellor. Tentative course approval prior to departing on an exchange is required.

In addition to undergraduate study programs, some countries offer summer research opportunities. A good example would be a research semester offered by the German Academic Exchange Service. More information can be found at: <http://www.daad.org/>.

### Co-operative Education Program

The co-operative education program offers an excellent opportunity to develop your technical and personal skills in the professional world. Participants in the co-op program must complete a minimum of four work semesters (out of the five available) alternated with eight academic semesters as indicated in the schedule below. Of the four required work semesters, one must be completed in the fall and one must be completed in the winter.

Year	September-December	January-April	May-August
1	Semester 1	Semester 2	Off
2	Semester 3	Semester 4	Work Semester
3	Semester 5	Work Semester	Work Semester
4	Semester 6	Semester 7	Work Semester
5	Work Semester	Semester 8	Graduate!

Students can enter the co-op program directly from secondary school or can be admitted, depending on space availability, after completion of Semester 2. Applications should be submitted directly to the Co-operative Education Office, 3<sup>rd</sup> Floor South in the University Centre.

Please consult the Co-operative Education website for more information about co-op programs or contact the Engineering Co-op Faculty Advisor, Dr. David Lubitz, [wlubitz@uoguelph.ca](mailto:wlubitz@uoguelph.ca):  
<http://www.cecs.uoguelph.ca/home/>

### Undergraduate Engineering Scholarships and Awards

Scholarships and awards are available to students with high academic achievement, involved in extra-curricular activities, or who are in financial need. A description of all available awards and eligibility requirements is provided in Section IX, Scholarships and Other Awards in the current Undergraduate Calendar and is updated every year. Several scholarships and awards are available only to engineering students. Please see the listing in the current Undergraduate Calendar for more information.

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c09/c09beng.shtml>

Dr. Ramesh Rudra, P.Eng. is the Chair of the School of Engineering Awards Committee. Please contact him at [rrudra@uoguelph.ca](mailto:rrudra@uoguelph.ca) if you have any questions or wish to apply for any of the Engineering awards.



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## Undergraduate Minor Degrees

Students majoring in the B.Eng. Program can add a minor from almost any degree program offered by the University of Guelph. Minors can be added at any time, however, if you plan to add one of the two Engineering Minors, you must do so before enrolling in ENGG\*3100 in Semester 6 [Regular] or Semester 7 [Coop]. If you select a minor degree program outside of Engineering, please contact the respective faculty advisor for the program you have chosen. A list of faculty advisors can be found on the Undergraduate Academic Information Centre website:  
<http://www.uoguelph.ca/uaic/students.shtml>

The minor program you follow must correspond to the same calendar year you began your Engineering Major. For example, if you began your Engineering degree in Fall 2008 and you add a minor in 2010, the program of study for the minor must follow the 2008/09 Undergraduate Calendar.

Please see Section X, Degree Programs, in the Undergraduate Calendar for more details about Minor Degree Programs:  
[http://www.uoguelph.ca/undergrad\\_calendar/c10/index.shtml](http://www.uoguelph.ca/undergrad_calendar/c10/index.shtml)

### *How to Apply For a Minor Degree*

You can obtain an "Undergraduate Schedule of Studies Change Request" form from Undergraduate Services on the 3rd floor of the University Centre. Both the B.Eng. Program Counsellor and the Faculty Advisor of the Minor program must sign the form prior to you submitting the form to Undergraduate Services.

## Continuation of Study

To remain in the Engineering program, all students must follow the Continuation of Study model outlined in Section VIII -Undergraduate Degree Regulations and Procedures in the Undergraduate Calendar.

To continue studying at the University of Guelph, you must satisfy the conditions set out in Schedule 1 or Schedule 2. Most students who are admitted directly from secondary school follow Schedule 1, whereas students who transfer or are re-admitted generally follow Schedule 2.

Please refer to the Undergraduate Calendar for further explanation or consult the Engineering Program Counsellor if you are unsure of which Schedule you are to follow:  
<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-contstudy.shtml>

Additionally, students are advised that there is a program restriction that takes effect in ENGG\*3100. Specifically, students must have a minimum cumulative average of 60% in all ENGG courses to register for ENGG\*3100.

## Graduation

**To qualify for your B.Eng. degree you must complete all of the required courses and elective courses as listed in the Schedule of Studies of the 2009-2010 Undergraduate Calendar and this Program Guide.**

To graduate, you must receive a minimum of 23.5 credits, achieve a minimum overall cumulative average of 60%, and achieve a minimum cumulative average of 60% in all ENGG courses. Please see Section X, Degree Programs, Bachelor of Engineering [B.Eng.] in the 2009/10 Undergraduate Calendar for full program requirements.

Refer to Section VIII - Undergraduate Degree Regulations and Procedures in the University of Guelph Undergraduate Calendar for an explanation of the general requirements for graduation.  
[http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/sec\\_d0e7443.shtml](http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/sec_d0e7443.shtml)

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It is each student's responsibility to know if their graduation requirements have been met. The best way to track your degree requirements is to consult your personal **Academic Evaluation** page on your Webadvisor account. The academic evaluation is an accounting sheet of the courses and credits that must be completed to qualify for your undergraduate degree major in addition to other programs in which you might be enrolled such as co-operative education, minors or certificates. The Academic Evaluation page also contains the following important information:

- Student name, mailing address and ID number
- Program (*major and, if applicable, co-op, minors, certificates*)
- Class Level (*needed to identify your course selection window*)
- Standing (*academic status at the end of previous semester; e.g., Dean's Honour List, Eligible to Continue, Probation, Required to Withdraw*)
- Catalogue (*indicates the undergraduate calendar year you are following for your Schedule of Studies*)
- Official uoguelph email address

### 3rd-Failure Rule

Students will be removed from the B.Eng. Program and will not be eligible for readmission to Engineering if the same course is failed three times (this includes elective courses). If you have failed a course three times and your continuation of study status is either eligible to continue or probationary, your university degree status will be changed to non-degree. If you are eligible to continue at the university, you may apply for admission to another degree offered by the University through the Admissions Department provided you meet the minimum admissions requirements. Students are advised to meet with the Program Counsellor for the degree program for which they wish to apply before making an application.

### Academic Standing

#### *Eligible to Continue (ETC)*

A student who satisfies the program requirements for continuation of study will be eligible to continue (ETC). Students who are ETC may register for courses on-line (via Webadvisor), provided they meet the prerequisite requirements.

#### *Probation (PRB)*

A student who is placed on probationary status will be permitted to continue in their program, but has been identified as being at academic risk. Students who are placed on probation are strongly advised to meet with their Program Counsellor to understand their academic options and request information about appropriate on-campus services that the student can access for help to get back on track (see Continuation of Study in this section for a link to Undergraduate Calendar regarding probation status).

#### *Required to Withdraw (RTW)*

A student who does not satisfy the program requirements for continuation of study will be required to withdraw from the University for a minimum of two semesters (see Continuation of Study in this section). Students who do not satisfy the program requirements may appeal to the Academic Review Committee for probationary status to be granted if they have medical, psychological or compassionate grounds as outlined in the Undergraduate Calendar. A student who has been required to withdraw and who has made an appeal for probationary status to the Academic Review Committee will not be allowed to attend classes until such time that the appeal is granted.

Readmission to a program at the University of Guelph after being required to withdraw is not automatic. Students who are required to withdraw are not permitted to register in courses during the two-semester rustication period and they must apply for readmission. Conditions for applying for readmission after being required to withdraw are provided at the following Undergraduate Calendar link:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-readmit.shtml>

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Students who have been required to withdraw, and wish to be readmitted to the B.Eng. Program must also meet the conditions for substantial upgrading. Please contact your Engineering Program Counsellor for more information on engineering upgrading requirements.

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## COURSE INFORMATION

### Course Selection

The course selection period for the following semester occurs near the mid-term point of the current semester. Students can pre-select their courses when their selection window opens. Selection windows are based on your student ID number and your class level, both of which can be found on your Academic Evaluation page on your Webadvisor account. The course schedule is available for viewing on Webadvisor approximately 2 weeks prior to the start of the course selection period. Students are advised to identify ahead of time sections that would work best for their Schedule of Studies and to identify back-up options in case their first choice fills before their window opens.

The final exam schedule is not available during the course selection period, but is posted prior to the beginning of the final add period for the following semester. It is the student's responsibility to check the final exam schedule before the next semester begins, and when adding courses to their schedule during the Final Add Period.

The final add period is open to all students with active status and there are no selection windows.

The start and end dates of all course selection periods and add periods are published in Section III, Schedule of Dates in the Undergraduate Calendar.

After the semester begins, requests to add a course after the last day of the add period, as published in the Schedule of Dates in the Undergraduate Calendar, will be denied unless the student can provide a reasonable explanation for extenuating circumstances. There is plenty of opportunity to add courses long before the semester begins. Line ups and/or neglect are not acceptable excuses.

### Course Prerequisites

The majority of courses offered by the School of Engineering have course prerequisites. As such, you need to obtain credit in the prerequisite course or courses before you are allowed to enrol in the subsequent course.

A student wishing to register in a course for which he/she does not have credit for the prerequisite(s) may request permission from the course instructor to have the prerequisite(s) waived. The student seeking the waiver must obtain a "Course Requisite/Restriction Waiver" form, request it to be signed by the instructor and submit the completed form to Undergraduate Services for processing. Waiver forms are available from Undergraduate Services, Office of Registrarial Services, 3<sup>rd</sup> Floor North of the University Centre.

The pink copy of the waiver form for all ENGG courses and MATH\*2270 must be submitted to the Engineering Program Counsellor, or else you risk being department dropped from the course and the section that best works in your schedule.

The decision to sign a waiver rests with the individual course instructor. However, the School of Engineering has recommended to all faculty members teaching ENGG courses that prerequisites be strictly enforced. One exception to this recommendation is for transfer students where extenuating circumstances exist. This does not mean that transfer students are guaranteed that waiver forms will be signed. The course instructor still makes the decision on an individual basis.

### Dropping Courses

Courses must be dropped by the end of the fortieth (40th) class day. Students wishing to drop a course after the fortieth (40th) class day must appeal to the Academic Review Committee and they must have grounds for academic consideration as outlined in the Undergraduate Calendar. Please note there is NO guarantee that your request will be granted. Please refer to Section VIII, Undergraduate Degree Regulations and Procedures

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in the Undergraduate Calendar for a description of grounds for Academic Consideration. Forms for Academic Consideration may be picked up at Undergraduate Services on the 3<sup>rd</sup> Floor of the University Centre.

It is important to remember that if you drop a course, you may not have the prerequisite for a subsequent course.

### Letters of Permission

From time to time, students who are off-stream from their Schedule of Studies may wish to take a course at another institution to get caught up in their program and/or back on sequence with their Program Guide. It is important to note that students are not permitted to be registered in more than one institution at the same time without first obtaining a Letter of Permission. Students who register at another institution without permission from their primary institution (i.e., University of Guelph) will be required to apply for readmission to their program. Readmission is not guaranteed and students would need to meet the minimum admission requirements.

Information regarding the procedure for requesting a Letter of Permission is provided in Section VIII of the Undergraduate Calendar:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-lop.shtml>

### Supplemental Privilege

Supplemental privileges are granted at the discretion of the Academic Review Committee, affording a student who has received a failing grade on the original course attempt, the opportunity to obtain credit for the course while retaining the original failing grade.

Students registered in the B.Eng. program are normally permitted only one supplemental privilege during their studies. A supplemental privilege may be granted for 3000 or 4000 level courses by the Academic Review Committee provided the course failure impacts the time line for graduation.

NOTE: A supplemental privilege is considered a separate course attempt and is intended to provide an evaluation of the full course material. If a student does not pass the supplemental privilege an additional failure in the course will be added to their transcript. Students who request a supplemental privilege are reminded that the B.Eng. degree has a 3<sup>rd</sup> failure rule which includes attempts for supplemental privilege.

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## COUNSELLING & HELP

### Engineering Program Counsellor

Academic counselling is available to you throughout your academic career at the University of Guelph. You are encouraged to take the initiative and seek advice from the Engineering Program Counsellor and/or Faculty within the School of Engineering when necessary. Typical situations include, but are not limited to, the following:

- experience personal difficulties that are affecting your courses
- have low marks even though you have been working hard
- feel that proper procedures aren't being followed in one of your classes
- wish to appeal a grade or decision
- wish to withdraw temporarily or permanently
- are having course selection problems
- wish to transfer programs or take courses at another institution
- have been ill and missed assignments, labs or exams

Although the door to the Program Counsellor's office is generally open, appointments are required for anything more than a quick question that results in an equally quick answer.

#### **There are two ways to book an appointment with the Engineering Program Counsellor:**

- 1 Submit the on-line request form located on the SOE Academic Website:  
<http://www.soe.uoguelph.ca/academic/pages/home.html#>
- 2 Contact the Engineering Undergraduate Secretary by phone or in person.

#### **B.Eng. Program Counsellor:**

Kim Thompson, P.Eng.

Room 201 Thornbrough (Engineering) Building

Phone: 519-824-4120 ext 56986, Fax: 519-836-0227

E-mail: [engcouns@uoguelph.ca](mailto:engcouns@uoguelph.ca)

#### **B.Eng. Undergraduate Secretary:**

Paula Brazier

Room 202 Thornbrough (Engineering) Building

Phone: 519-824-4120 ext 56572, Fax: 519-836-0227

E-mail: [pbrazier@uoguelph.ca](mailto:pbrazier@uoguelph.ca)

If you prefer to ask your question by email without booking an appointment, you are also requested to use the on-line form.

**The B.Eng. Program Counsellor email account, [encouns@uoguelph.ca](mailto:encouns@uoguelph.ca), receives a large volume of emails daily. Using the on-line form will give priority to your question or appointment request. Emails not received via the on-line request form may not receive a reply for several days and at times up to a week, depending on volume.**

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## Engineering Peer Helper Program

The Engineering Peer Helper Program is a partnership between the School of Engineering (SOE) and Learning Services of the Learning Commons to support engineering students. The program officially started in Winter 2009. Academically successful and experienced engineering students are hired by the SOE and trained by Learning Services to provide assistance with problem-solving and other learning strategies necessary for success in engineering courses.

Engineering Peer Helpers provide valuable assistance to students registered in the B.Eng. program through structured study sessions and individual assistance on learning-related issues. The Engineering Peer Helper program is specifically designed to target the development of skills and methodologies for problem solving, time management and exam preparation as it relates to the engineering curriculum.

Although specific engineering courses are associated with the Engineering Peer Helper program for the purpose of demonstration and implementation of various learning strategies, registration in these courses is not mandatory to be eligible to attend the sessions. All students registered in the B.Eng. program are encouraged to attend. The Engineering Peers are like coaches who are equipped to teach essential skills in a relaxed and friendly environment. They do not teach course content or fundamental concepts. You must go to class for that or meet with your course instructor during posted office hours.

Recruitment for new Engineering Peers takes place in February of each year.

More information about the dates and times of the Engineering Peer Helper study sessions will be announced on the SOE website and will be emailed to all students registered in the B.Eng. program at various times throughout the year.

## Other On-Campus Help Services

### *Counselling Services*

The University provides a broad range of on campus programs, services and resources to help students deal with any academic and personal issues. We want to provide you with all the necessary resources to ensure your success at Guelph!

Counsellors and therapists from a variety of backgrounds provide support to students who are experiencing problems of a personal nature. Counselling offers you the opportunity to talk to a counsellor to explore, understand and work through personal issues and meet your goals. Students may seek personal or group counselling to deal with issues such as adjusting to university life, interpersonal difficulties, relationships, stress management, depression, eating concerns or bereavement. Counselling Services is located on Level 3 in the University Centre or at ext. 53244.

<http://www.counselling.uoguelph.ca/counselling/>

### *Learning Services*

The goal of Learning Services is to promote excellence in learning and writing across the university curriculum and into the world of work. A broad range of services is provided for undergraduate students including workshops, seminars, non-credit courses, individual consultations, printed resources and on-line services. Services that may be of interest to engineering students include:

- Exam Preparation
- Learning from Lectures
- Learning from Texts
- Learning with Computers
- Memory & Concentration
- Presentation Skills
- Time Management
- Working in Groups

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Learning Services is located in the Learning Commons on the first floor of the Library.

### *The Learning Commons*

The Learning Commons is a consortium that links together the Library, Computing and Communications Services, Office of Open Learning, Student Affairs, Teaching Support Services. With student learning at its focus, Guelph's Learning Commons consolidates services related to teaching, learning, writing, research, and information and computer literacy into one area. The Learning Commons is located on the first floor of the McLaughlin Library, in the south-west corner behind the CCS computer pool.

<http://www.learningcommons.uoguelph.ca/index.html>

### *Stress Management and High Performance Clinic*

The clinic teaches self-regulation skills training for performance and health to clients from university, health care, and community settings in group, private, and on-site programs. Programs offered include Relaxation and Stress Management Skills, Preventing Repetitive Strain at Computer Tasks, Better Sleep Program, and examSMART. All classes are taught by Kathy Somers, BSc(HK) who is BCIA certified in Stress Management Education.

[http://www.uoguelph.ca/uaic/students\\_stressmanagement.shtml](http://www.uoguelph.ca/uaic/students_stressmanagement.shtml)

OR

<http://www.uoguelph.ca/%7Eksomers/>

## Academic Consideration

As printed in the Undergraduate Calendar, "The University of Guelph is committed to supporting students in their learning experiences and responding to their individual needs. To this end a broad network of advising, counselling, and support services is provided to assist students in meeting their personal and academic goals. The University is aware that a variety of situations or events beyond the student's control may affect academic performance. Support is provided to accommodate academic needs in the face of personal difficulties or unforeseen events. Procedures for academic appeals are designed to ensure that every effort is made at these times to provide appropriate accommodation and consideration, thus enabling students to complete course and program requirements as quickly as possible.

Knowledge of the procedures, early action on the student's part, timely consultation with the instructor(s) and/or program counsellor, and immediate provision of any required documentation will facilitate a prompt, coordinated institutional response.

The University will consider granting consideration for courses if there are sufficient extenuating medical, psychological or compassionate circumstances. Academic Consideration may take the form of an extended deadline, a deferred privilege, a late drop of a course(s) with or without failure, withdrawal from a semester with or without academic failure, or permission to continue on probationary status. A deferred privilege could take the form of approval to write a missed final examination or the completion of a course requirement after the end of the semester. Academic consideration is granted when acceptable medical, psychological or compassionate circumstances affect any portion of the semester work. Generally, work commitments will not constitute grounds for academic consideration. Depending upon the circumstances and whether the semester work is complete, consideration may be granted by the instructor, the program counsellor or the Academic Review Sub-Committee of the program in which the student is registered."

Please refer to the University Calendar for further details:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac-ac.shtml>

### *Submission Deadlines*

Submission deadlines for request for Academic Consideration are published in Section III, Schedule of Dates of the current Undergraduate Calendar. All requests for Academic Consideration must be submitted to Undergraduate Services, 3<sup>rd</sup> Floor North in the University Centre. Forms may be obtained at the same



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location or from the Program Counsellor or on-line at the following link:  
<http://www.uoguelph.ca/registrar/index.cfm?downloads>

### Grounds for Academic Consideration

Requests for academic consideration are to be accompanied by supporting documentation to the extent possible. Students unsure of documentation requirements should contact their Program Counsellor. Requests that cannot be substantiated through appropriate documentation may be denied.

#### *Psychological Grounds*

For academic consideration based on psychological grounds the student will be asked to provide documentation for the period affected. The necessity for documentation will depend in part upon the length of the problem and the amount of work missed during this time. During the semester, the student should submit this documentation to the Program Counsellor who will then advise the instructor of the need for consideration. After completion of the semester, the student must apply to the Academic Review Sub-committee for consideration. When the psychological difficulty affects final examinations or final assignments, Counselling Services, upon receipt of student authorization, may send supporting documentation to the Program Counsellor. If the difficulty is of a duration that will affect a number of courses or completion of the semester's work, the student should contact the Program Counsellor for advice and to discuss their academic options.

#### *Compassionate Grounds*

Unforeseen circumstances beyond the student's control in either their personal or family life may affect academic performance. The procedure to follow to request academic consideration based on compassionate grounds depends upon the severity of the circumstance and the amount of work missed. During the semester, students may wish to contact the instructor for consideration for missed semester work resulting from a compassionate circumstance. If the circumstance is more significant or if the semester is complete, the student should consult with the Program Counsellor for advice in making an application to the Academic Review Sub-committee. Generally, work commitments will not constitute grounds for academic consideration.

#### *Medical Grounds*

For academic consideration based on medical grounds a student may be asked to provide medical documentation for the period of the illness. The necessity for documentation will depend in part upon the length of the illness and the amount of work missed during this time. If the medical situation results in missed semester work during the semester, the student should contact the instructor, presenting medical documentation where warranted. If the absence due to illness is of a duration that will affect a number of courses or completion of the semester's work, the student should contact the Program Counsellor for advice and to discuss their academic options. When the absence affects final examinations or final assignments the student should go to Student Health Services or a personal physician for documentation. The student must present the medical documentation to the Program Counsellor.

#### *Off-campus Medical Documentation*

If you seek medical attention off-campus, the doctor must complete a School of Engineering Off Campus Medical Form which can be obtained from the SOE Website, or print the form provided in this program guide: [http://www.soe.uoguelph.ca/academic/pages/forms/off\\_campus\\_medical\\_note\\_050902.pdf](http://www.soe.uoguelph.ca/academic/pages/forms/off_campus_medical_note_050902.pdf)

#### *Exclusions*

Missing assignment due dates, midterms and/or final exams due to sleeping in, faulty alarm clocks, entertainment events, flight or travel plans, vacation and/or misreading course outlines, final exam schedules or deferred exam schedules does not constitute grounds for consideration.

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## FINAL EXAMS

### Final Exam Conflicts

There is no legitimate reason for a student to have a timetable conflict during the final exam period. It is the student's responsibility to check the final exam schedule for all of their courses during the Final Add Period immediately prior to the start of the semester. The final exam schedule is made available to students on Webadvisor approximately 4 weeks prior to the beginning of each semester. If a student identifies a final exam scheduling conflict, they are required to make adjustments to their course selections before the end of the final add period prior to the commencement of the semester. Exam conflicts usually occur when a student adds a course AFTER the exam schedule has been published, but they have neglected to check the exam dates at the time when they added the course.

If a student wishes to keep their course selections after identifying a final exam conflict, they are strongly advised to consult with the course instructor BEFORE the semester begins to request an alternate time to write the final exam. The course instructor is not obligated to grant the request and may require documentation from the student to verify the reason for the request.

If the instructor grants the request, it is the instructor's responsibility to personally accommodate the student within the official final exam period and before the instructor's deadline to submit final grades to the registrar for their individual course (typically, 7 days after the official date of the final exam). The start and end dates of the official final exam period are published in Section III, Schedule of Dates in the Undergraduate Calendar.

### Missed Final Exams

Missing a final exam is a serious academic situation. Students may be granted a deferred final exam ONLY if they have legitimate grounds for academic consideration.

The most common reason for missing a final exam is due to illness. Normally, the Academic Review Committee will not grant academic consideration to a student who chooses to write a final exam, and then afterward states that their medical, psychological or compassionate condition impacted their performance on the exam.

If a student feels that their academic performance on a final exam is in jeopardy due to their medical, psychological or compassionate circumstances, it is the student's responsibility to consult their Program Counsellor as soon as possible so as to initiate action, and provide any required documentation.

**Medical documentation for a missed final exam should always be submitted directly to the Program Counsellor or Undergraduate Secretary.**

Requests for academic consideration for a missed final exam based upon psychological or compassionate grounds must be submitted to Undergraduate Program Services (UC Level 3) on an appropriately completed Request for Academic Consideration form, along with any supporting documentation. Please refer to the Undergraduate Calendar, VIII Undergraduate Degree Regulations and Procedures, Academic Consideration, Appeals and Petitions and/or the Academic Consideration section in this program guide for more information on how to make a request.

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

Students who are ill on the day of a final exam are advised to visit the on-campus Student Health Services, an off-campus medical clinic, or Emergency Services at Guelph General Hospital before attempting to write a final exam. **Students, who state they were able to attend a final exam but were not able to seek medical services, will be denied academic consideration.**

If a student visits a physician off-campus, an off-campus medical form is required. The off-campus medical form, located on the SOE website and also printed in this Program Guide, must be filled out by the attending physician. It is the student's responsibility to ensure that the physician clearly provide all pertinent information

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regarding the effects of the medical condition that prevented the student from writing the exam, the date of the medical examination and, where applicable, the dates the student would have been severely or moderately affected.

The Academic Review Committee and/or the Program Counsellor have the right to deny medical consideration under one or more of the following conditions:

- Absence of an off-campus medical note or a medical note from Student Health Services.
- Apparent discrepancies in dates or the medical condition.
- The medical condition is deemed by the attending physician as being slight, negligible, or inconclusive.
- The medical examination is conducted after the symptoms of the illness have passed and the documentation is based solely on the student's description of the illness.

### *Procedures for the Fall Semester (ENGG courses only)*

Students who miss a final exam for an ENGG course or MATH\*2270 in the **fall semester only** are granted a deferred condition if appropriate documentation is provided to support their grounds for the request. The deferred condition for a missed final exam will be in the form of a two-hour exam to be written during the first week of classes of the subsequent winter semester. Exam schedules for “**Deferred Conditions**” are published on the School of Engineering website:

<http://www.soe.uoguelph.ca/academic/pages/home.html>

Medical documentation must be submitted to the Program Counsellor before the first week of classes of the subsequent winter semester to be granted a deferred condition.

Students who are granted a deferred final exam for any other courses taken in the Fall Semester will write the deferred final exam during the scheduled deferred exam period as published in Section III, Schedule of Dates in the Undergraduate Calendar. Deferred final exam schedules will be posted on Webadvisor, as required.

### *Procedures for the Winter and Summer Semesters (all courses)*

Students who are granted a deferred final exam for any course taken in the Winter or Summer Semesters will write the deferred final exam during the scheduled deferred exam period as published in Section III, Schedule of Dates in the Undergraduate Calendar. Deferred final exam schedules will be posted on Webadvisor, as required.

## Deferred Final Exam Period

When a student makes a request for a deferred final exam, it is their responsibility to be prepared to write the exam during the scheduled deferred exam period as published in Section III, Schedule of Dates in the Undergraduate Calendar, or the scheduled deferred condition period posted on the SOE website, **regardless of when they receive confirmation from the registrar that the deferred exam or deferred condition was granted.**

The start and end dates of the scheduled deferred exam period are published in the Schedule of Dates in the Undergraduate Calendar. The actual date and time of the exam requested by the student will be communicated to the student via their uoguelph email account once the deferred exam schedule is finalized. The deferred exam schedule will also be posted on Webadvisor.

A student, who cannot attend their deferred exam or deferred condition, as scheduled, must make a request for academic consideration to receive an extension and they must have grounds for their request.

# University of Guelph – School of Engineering

## Verification of Illness Form

Patient (Student) Name: \_\_\_\_\_

Student ID Number: \_\_\_\_\_

**PHYSICIAN TO COMPLETE:**

Please specify the degree and dates of incapacitation and mark an (X) for the applicable category, as appropriate:

- Severe: [Unable to attend class or exam from \_\_\_\_\_ to \_\_\_\_\_, (date)]
- Moderate: [Able to fulfill some academic obligations, but performance will be/would have been significantly affected from \_\_\_\_\_ to \_\_\_\_\_, (date)]
- Slight/Negligible: [Should not have/had any significant affect on ability to fulfill academic obligations]
- Other: [Can't provide/verify illness – not seen here]

**The above assessment of the patient's illness is based on:**

- The degree of incapacitation is based on the patient's description of his/her illness.
- The degree of incapacitation is based on an examination performed on \_\_\_\_\_, (date). This medical condition has necessitated \_\_\_\_\_ visits.
- The symptoms of illness and/or side effects of medication may include:

Drowsiness	Lack of Concentration
Insomnia	Loss of Memory
Pain	Other

**Additional Comments**

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**PHYSICIAN TO COMPLETE:**

Date:	Signature:	Physician (Y/N) Nurse (Y/N)
CPSO Registration #:	Physician's Address/Stamp:	

**STUDENT TO COMPLETE:**

I have read and understood the above information pertaining to my illness. I hereby give permission for the release of this information to my course instructor, program counsellor and/or the Academic Review Subcommittee, as required at the University of Guelph.

Name (print): \_\_\_\_\_ Signature: \_\_\_\_\_

Date: \_\_\_\_\_

Questions should be directed to the Engineering Program Counsellor, Kim Thompson, P.Eng. at: 519 824-4120 ext 56986 or [engcouns@uoguelph.ca](mailto:engcouns@uoguelph.ca)

**It is the student's responsibility to notify the Course Instructor(s) and Program Counsellor of any illness that will affect academic performance.**

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## SCHEDULE OF STUDIES

Detailed course listings for each of the four B.Eng. degree majors are provided in the following sections, including lists for program-specific electives and complementary studies electives. Information regarding prerequisite requirements, course credit weighting, semester offerings and any pertinent restrictions is also provided. Course requirements for the two B.Eng. minor programs are located at the end of this section.

Students should pay particular attention to the restrictions associated with entry into the 3<sup>rd</sup> and 4<sup>th</sup> year core design courses. In both cases, students in the B.Eng. program must have a minimum cumulative average of 60% in all ENGG courses to be permitted to register for ENGG\*3100 and 41X (i.e., ENGG\*4110, ENGG\*4120, ENGG\*4130, ENGG\*4150 and ENGG\*4160), otherwise known as final design.

Students who do not achieve the 60% ENGG criterion by the end of Semester 4 should meet with the Program Counsellor to discuss their academic options. A cumulative tally of the ENGG course average is provided on your individual Academic Evaluation on your Webadvisor account.

## FINAL DESIGN (41X)

All engineering students must successfully complete the capstone design project course associated with their engineering program in their final academic semester. Registration in 41X requires a pre-graduation check by the engineering program counsellor. You cannot add 41X on Webadvisor. Instructions for registration in 41X are available upon request from the program counsellor.

Students are responsible for creating their own design group of 3 or 4 students and for finding a faculty advisor for their project. **The faculty advisor MUST be a licensed Professional Engineer (P.Eng.). Students can search the SOE Faculty webpage to identify faculty members who have obtained P.Eng. status: <http://www.soe.uoguelph.ca/faculty/index.html>**

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## Biological Engineering [Regular and Coop] Schedule of Studies

### Semester 1 (Fall) Regular or Co-op

CHEM\*1040 [0.50] General Chemistry I  
 CIS\*1500 [0.50] Introduction to Programming  
 ENGG\*1100 [0.75] Engineering and Design I  
 MATH\*1200 [0.50] Calculus I

One of:

ENGG\*1210 [0.50] Engineering Mechanics I  
 HIST\*1250 [0.50] Science & Society Since 1500

### Prerequisites

One of 4U Chemistry, OAC Chemistry (or equivalent), CHEM\*1060  
 None  
 None  
 4U Advanced Functions and Calculus or OAC Calculus

### Semester 2 (Winter) Regular or Co-op

CHEM\*1050 [0.50] General Chemistry II  
 ENGG\*1500 [0.50] Engineering Analysis  
 MATH\*1210 [0.50] Calculus II  
 PHYS\*1130 [0.50] Physics With Applications

One of:

ENGG\*1210 [0.50] Engineering Mechanics I  
 HIST\*1250 [0.50] Science & Society Since 1500

### Prerequisites

CHEM\*1040  
 Co-requisites ENGG\*1210, MATH\*1210  
 1 of MATH\*1000, MATH\*1080, MATH\*1200 (MATH\*1200 preferred)  
 (MATH\*1080 or MATH\*1200), [1 of 4U Physics, OAC Physics (or equivalent), PHYS\*1020]

### Semester 3 (Fall) Regular or Co-op

COOP\*1100 [0.00] Intro to Co-operative Education  
 ENGG\*2120 [0.50] Material Science  
 ENGG\*2160 [0.50] Engineering Mechanics II  
 ENGG\*2400 [0.50] Engineering Systems Analysis

MATH\*2270 [0.50] Applied Differential Equations

One of:

BIOL\*1030 [0.50] Biology I [1]  
 MICR\*1020 [0.50] Fundamentals of Appl'd Microbiology [1]

One of:

ENGG\*2100 [0.75] Engineering and Design II  
 STAT\*2120 [0.50] Probability and Statistics for Engineers

### Prerequisites

Co-op students only as requirement for entry into the first work term  
 CHEM\*1040, PHYS\*1130  
 ENGG\*1210, ENGG\*1500, [0.50] credits in Calculus  
 ENGG\*1210, ENGG\*1500, MATH\*1200, MATH\*1210, PHYS\*1130, Co-requisite MATH\*2270  
 ENGG\*1500, MATH\*1210

4U Biology (or Grade 12 Biology) strongly recommended  
 4U Biology (or Grade 12 Biology) strongly recommended

Completion of 4.0 credits including ENGG\*1100  
 1 of MATH\*1010, MATH\*1210, MATH\*2080, IPS\*1210

[1] If BIOL\*1030 is chosen instead of MICR\*1020 as the core requirement in Semester 3, then BIOL\*1040 must be taken in Semester 5 as the restricted elective, and will take the place of one free elective. Note that BIOL\*1030 does NOT equate to MICR\*1020. Therefore, BIOL\*1030 alone will not be sufficient to graduate; students must also take BIOL\*1040.

If MICR\*1020 is chosen instead of BIOL\*1030 as the core requirement in Semester 3, then BIOL\*1040 is not required in Semester 5. Students may select from any of the elective choices on the following page in Semester 5.

### Semester 4 (Winter) Regular or Co-op

BIOC\*2580 [0.50] Introductory Biochemistry  
 ENGG\*2230 [0.50] Fluid Mechanics  
 ENGG\*2450 [0.50] Electric Circuits  
 ENGG\*2660 [0.50] Biological Engineering Systems I  
 MATH\*2130 [0.50] Numerical Methods

One of:

ENGG\*2100 [0.75] Engineering and Design II  
 STAT\*2120 [0.50] Probability and Statistics for Engineers

### Prerequisites

CHEM\*1050 or CHEM\*2300  
 ENGG\*1210, MATH\*1210  
 ENGG\*2400, (PHYS\*1010 or PHYS\*1130)  
 ENGG\*2400, MATH\*2270, (BIOL\*1030 or MICR\*1020)  
 MATH\*1210 or MATH\*2080

Completion of 4.0 credits including ENGG\*1100  
 1 of MATH\*1010, MATH\*1210, MATH\*2080, IPS\*1210

Schedule of Studies continued on next page...

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## Biological Engineering [Regular and Coop] Schedule of Studies

### Semester 5 (Fall) Regular or Co-op

ENGG*3160	[0.50] Biological Engineering Systems II
ENGG*3170	[0.50] Biomaterials
ENGG*3240	[0.50] Engineering Economics
ENGG*3260	[0.50] Thermodynamics
ENGG*3450	[0.50] Electrical Devices
One of:	see note [1] above
BIOL*1040	[0.50] Biology II
ELECTIVE	[0.50] Restricted Elective

### Prerequisites

ENGG\*2230, ENGG\*2660  
ENGG\*2120  
MATH\*1210  
CHEM\*1040, ENGG\*2230, ENGG\*2400, MATH\*2270  
ENGG\*2450  
  
BIOL\*1030  
See elective lists

### Semester 6 (Winter) Regular or Semester 7 (Winter) Co-op

ENGG\*3100 [0.75] Engineering and Design III

### Prerequisites

Registration in the B.Eng. program and completion of 6.00 credits of ENGG courses including ENGG\*2100  
Students must have a minimum cumulative average of 60% in all ENGG courses for entry into ENGG\*3100. Restriction waiver requests are handled by the Director, School of Engineering, or designate.  
ENGG\*2400, MATH\*2270, Co-requisite ENGG\*2450  
ENGG\*2230, ENGG\*3260, MATH\*2270  
See elective lists

ENGG\*3410 [0.50] Systems and Control Theory  
ENGG\*3430 [0.50] Heat and Mass Transfer  
ELECTIVE [1.00] Restricted Electives

### Semester 7 (Fall) Regular or Semester 6 (Fall) Co-op

ENGG\*4390 [0.75] Bio-Instrumentation Design  
ELECTIVE [2.75] Restricted Electives

### Prerequisites

ENGG\*3450  
See elective lists

### Semester 8 (Winter) Regular or Co-op

ENGG\*4110 [1.00] Biological Engineering Design IV

### Prerequisites

All 1000 and 2000 level core credits plus ENGG\*3100. Must be enrolled in the B.Eng. Program. This course must be taken in the final semester with a maximum of 3.25 credits. Admission to the course is by instructor's permission in the semester prior to the course offering.  
Students must have a minimum cumulative average of 60% in all ENGG courses for entry into ENGG\*4110. Restriction waiver requests are handled by the Director, School of Engineering, or designate.  
ENGG\*3410  
See elective lists

ENGG\*4280 [0.75] Digital Process Control Design  
ELECTIVE [1.00] Restricted Electives

## *Biological Engineering Restricted Electives*

Biological engineering students must complete the following restricted electives. You can take these courses where Restricted Electives are indicated in the Schedule of Studies above.

**A maximum of 1.5 credits at the 1000 course level is allowed for elective requirements.**

[1.00] credit in Biological Engineering Electives in **List BIOE-1**

[0.75] credit in Biological Engineering Design Electives in **List BIOE-2**

[2.00] credits in Complementary Studies Electives in **Lists CS-1, CS-2 and CS-3**

(Complementary Studies elective list is located at the back of this program guide)

[1.50] credits in Free Elective

(MATH\*2150 Applied Matrix Algebra cannot be used as a free elective. The material is redundant for Biological Engineering students.)

Semester offerings for courses may change without notice. Students should refer to the current Undergraduate Calendar to confirm that the course will be offered in the semester indicated in the elective lists within this program guide.

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### Biological Engineering [Regular and Coop] Schedule of Studies

#### List BIOE-1:

#### Biological Engineering Electives (1.0 Credit)

ENGG*2410 [0.50]	Digital Systems Design Using Descriptive Languages, F	(CIS*1650 or CIS*1500), PHYS*1130
ENGG*3150 [0.50]	Engineering Biomechanics, W	ENGG*2160
ENGG*3180 [0.50]	Air Quality, F	ENGG*2230, (ENGG*2560 or ENGG*2660) Co-requisite ENGG*3260
ENGG*3390 [0.50]	Signal Processing, F	ENGG*2400
ENGG*3590 [0.50]	Water Quality, F	ENGG*2230, ENGG*2560, (BIOL*1040 or MICR*1020), STAT*2120
ENGG*3640 [0.50]	Microcomputer Interfacing, F	ENGG*2410, Co-requisite ENGG*3390
ENGG*3830 [0.50]	Bio-Process Engineering, F	ENGG*2230, ENGG*2660 Co-requisite ENGG*3260
ENGG*4260 [0.75]	Water and Wastewater Treatment Design, W	ENGG*3100, ENGG*3590
ENGG*4300 [0.75]	Food Processing Engineering Design, F	ENGG*3260, ENGG*3830
ENGG*4340 [0.50]	Solid & Hazardous Waste Management, F	ENGG*2560 or ENGG*2660
ENGG*4380 [0.75]	Bioreactor Design, W	ENGG*3160
ENGG*4400 [0.75]	Biomechanical Engineering Design, F	ENGG*2120, Co-requisite ENGG*3170
ENGG*4510 [0.50]	Assessment & Management of Risk, W	STAT*2040 or STAT*2120
ENGG*4660 [0.50]	Medical Imaging Processing, W	ENGG*3390

#### List BIOE-2:

#### Biological Engineering Design Electives (0.75 Credits)

ENGG*4300 [0.75]	Food Processing Engineering Design, F	ENGG*3260, ENGG*3830
ENGG*4380 [0.75]	Bioreactor Design, W	ENGG*3160
ENGG*4400 [0.75]	Biomechanical Engineering Design, F	ENGG*2120, Co-requisite ENGG*3170

**Note: The courses in List BIOE-2 are also available in List BIOE-1. These courses cannot be counted towards more than one Elective List requirement.**

### *Conditions for Graduation*

To qualify for the degree, the student must complete the courses required for the Bachelor of Engineering Program in Biological Engineering, obtaining a minimum of 23.50 credits, and must achieve an overall minimum cumulative average of at least 60% and a minimum cumulative average of at least 60% in all ENGG courses.

**End of biological engineering program requirements for students following the 2008/09 Undergraduate Course Calendar.**



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# Engineering Program Guide (Fall 2009- Winter 2010)

## Engineering Systems and Computing [Regular and Coop] Schedule of Studies

### Semester 1 (Fall) Regular or Co-op

CHEM*1040	[0.50] General Chemistry I
CIS*1500	[0.50] Introduction to Programming
ENGG*1100	[0.75] Engineering and Design I
MATH*1200	[0.50] Calculus I
One of:	
ENGG*1210	[0.50] Engineering Mechanics I
HIST*1250	[0.50] Science & Society Since 1500

### Prerequisites

One of 4U Chemistry, OAC Chemistry (or equivalent), CHEM*1060
None
None
4U Advanced Functions and Calculus or OAC Calculus
None
None

### Semester 2 (Winter) Regular or Co-op

CIS*2500	[0.50] Intermediate Programming
ENGG*1500	[0.50] Engineering Analysis
MATH*1210	[0.50] Calculus II
PHYS*1010	[0.50] Introductory Electricity and Magnetism
PHYS*1130	[0.50] Physics with Applications

### Prerequisites

CIS*1500; Equates: CIS*2650
Co-requisites ENGG*1210, MATH*1210
1 of MATH*1000, MATH*1080, MATH*1200 (MATH*1200 preferred)
(MATH*1080 or MATH*1200), [1 of 4U Physics, OAC Physics, PHYS*1020]
(MATH*1080 or MATH*1200), [1 of 4U Physics, OAC Physics (or equivalent), PHYS*1020]

One of:

ENGG*1210	[0.50] Engineering Mechanics I
HIST*1250	[0.50] Science & Society Since 1500

None
None

### Semester 3 (Fall) Regular or Co-op

COOP*1100	[0.00] Intro to Co-operative Education
CIS*2430	[0.50] Object Oriented Programming
ENGG*2120	[0.50] Material Science
ENGG*2400	[0.50] Engineering Systems Analysis
ENGG*2410	[0.50] Digital Systems Design Using Descriptive Languages
MATH*2270	[0.50] Applied Differential Equations
One of:	
ENGG*2100	[0.75] Engineering and Design II
STAT*2120	[0.50] Probability and Statistics for Engineers

### Prerequisites

Co-op students only as requirement for entry into the first work term
CIS*2500
CHEM*1040, PHYS*1130
ENGG*1210, ENGG*1500, MATH*1200, MATH*1210, PHYS*1130, Co-requisite MATH*2270
(CIS*1650 or CIS*1500), PHYS*1130
ENGG*1500, MATH*1210
Completion of 4.0 credits including ENGG*1100
1 of MATH*1010, MATH*1210, MATH*2080, IPS*1210

### Semester 4 (Winter) Regular or Co-op

CIS*3110	[0.50] Operating Systems
ENGG*2230	[0.50] Fluid Mechanics
ENGG*2450	[0.50] Electric Circuits
MATH*2130	[0.50] Numerical Methods
ELECTIVE	[0.50] Restricted Elective
One of:	
ENGG*2100	[0.75] Engineering and Design II
STAT*2120	[0.50] Probability and Statistics for Engineers

### Prerequisites

(CIS*2500 or CIS*2650), Recommended (CIS*2030 or ENGG*2410)
ENGG*1210, MATH*1210
ENGG*2400, (PHYS*1010 or PHYS*1130)
MATH*1210 or MATH*2080
See elective lists

Completion of 4.0 credits including ENGG*1100
1 of MATH*1010, MATH*1210, MATH*2080, IPS*1210

### Semester 5 (Fall) Regular or Co-op

CIS*2520	[0.50] Data Structures
ENGG*3260	[0.50] Thermodynamics
ENGG*3390	[0.50] Signal Processing
ENGG*3450	[0.50] Electrical Devices
ENGG*3640	[0.50] Microcomputer Interfacing
ELECTIVE	[0.50] Restricted Elective [1]

### Prerequisites

(CIS*1900 or CIS*1910) or (ENGG*1500, ENGG*2410), CIS*2500; Equates: CIS*2420
CHEM*1040, ENGG*2230, ENGG*2400, MATH*2270
ENGG*2400
ENGG*2450
ENGG*2410, Co-requisite ENGG*3390
See elective lists

[1] Students following the Mechatronics Stream in List ESC-1 are strongly encouraged to take ENGG\*3380 in Semester 5 of their program due to the possibility of timetable conflicts between ENGG\*3380 and core courses in Semester 7. The SOE will make every effort to avoid such conflicts but this cannot be guaranteed.

Schedule of Studies continued on next page...

# Engineering Program Guide (Fall 2009- Winter 2010)

## Engineering Systems and Computing [Regular and Coop] Schedule of Studies

Semester 6 (Winter) Regular or Semester 7 (Winter) Co-op  
ENGG\*3100 [0.75] Engineering and Design III

### Prerequisites

Registration in the B.Eng. program and completion of 6.00 credits of ENGG courses including ENGG\*2100

Students must have a minimum cumulative average of 60% in all ENGG courses for entry into ENGG\*3100. Restriction waiver requests are handled by the Director, School of Engineering, or designate.

ENGG\*3410 [0.50] Systems and Control Theory  
ENGG\*3430 [0.50] Heat and Mass Transfer  
ELECTIVE [1.00] or [1.25] Restricted Electives [2]

ENGG\*2400, MATH\*2270, co-requisite ENGG\*2450  
ENGG\*2230, ENGG\*3260, MATH\*2270  
See elective lists

[2] If ENGG\*3490 [0.75] is selected from List ESC-2 to meet the Engineering Design Elective Requirement, then the elective count will total 1.25 credits in Semester 6. Otherwise, the elective count for Semester 6 will be 1.0 credit. The Engineering Design Elective ENGG\*4390 [0.75] can be taken in Semester 7 (or) ENGG\*3490 in Semester 8.

Semester 7 (Fall) Regular or Semester 6 (Fall) Co-op  
ENGG\*3240 [0.50] Engineering Economics  
ENGG\*4420 [0.75] Real-time Systems Design  
ENGG\*4450 [0.50] Large-Scale Software Architecture Engineering  
ELECTIVE [1.00] or [1.25] Restricted Electives [3]

### Prerequisites

MATH\*1210  
CIS\*3110  
(CIS\*2420 or CIS\*2520), ENGG\*2100  
See elective lists

[3] If ENGG\*4390 [0.75] is selected from List ESC-2 to meet the Engineering Design Elective Requirement, then the elective count will total 1.25 credits in Semester 7. Otherwise, the elective count for Semester 7 will be 1.0 credit. The Engineering Design Elective, ENGG\*3490 [0.75] can be taken in either Semester 6 or Semester 8.

Semester 8 (Winter) Regular or Co-op  
ENGG\*4120 [1.00] Engineering Systems and Computing  
Design IV

### Prerequisites

All 1000 and 2000 level core credits plus ENGG\*3100. Must be enrolled in the B.Eng. Program. This course must be taken in the final semester with a maximum of 3.25 credits. Admission to the course is by instructor's permission in the semester prior to the course offering. Students must have a minimum cumulative average of 60% in all ENGG courses for entry into ENGG\*4120. Restriction waiver requests are handled by the Director, School of Engineering, or designate.

ENGG\*4280 [0.75] Digital Process Control Design  
ELECTIVE [1.00] or [1.25] Restricted Electives [4]

ENGG\*3410  
See elective lists

[4] If ENGG\*3490 [0.75] is selected from List ESC-2 to meet the Engineering Design Elective Requirement, then the elective count will total 1.25 credits in Semester 8. Otherwise, the elective count for Semester 8 will be 1.0 credit. The Engineering Design Elective ENGG\*3490 [0.75] can be taken in Semester 6 (or) ENGG\*4390 in Semester 7.

### *Engineering Systems and Computing Restricted Electives*

Engineering Systems & Computing students must complete the following restricted electives. You can take these courses where Restricted Electives are indicated in the Schedule of Studies above.

**A maximum of 1.5 credits at the 1000 course level is allowed for elective requirements.**

- [1.50] credits in ES&C Engineering Electives in **List ESC-1**
- [0.75] credits in ES&C Engineering Design Electives in **List ESC-2**
- [2.00] credits in Complementary Studies electives in **Lists CS-1, CS-2 and CS-3**  
(Complementary Studies elective list is located at the back of this program guide)

# Engineering Program Guide (Fall 2009- Winter 2010)

## Engineering Systems and Computing [Regular and Coop]

The ES&C Program offers four streams for further specialization. These streams consist of elective courses in List ESC-1 and ESC-2. The streams are: Mechatronics (M), Biomedical (B), Embedded Systems (E) and Computing (C). Students who wish to strengthen their knowledge in a particular specialization are encouraged to take all 2.25 credits from one stream. Streams have been noted beside each elective course. Streams are optional and students are free to mix and match between streams or pick any elective courses from List ESC-1 and ESC-2 to complete the required elective credit.

Semester offerings for courses may change without notice. Students should refer to the current Undergraduate Calendar to confirm that the course will be offered in the semester indicated in the elective lists within this program guide.

### List ESC-1:

#### ES&C Engineering Electives (1.50 Credits)

ENGG*3050	[0.50]	Embedded Reconfigurable Computing Systems, W (E)	ENGG*3380, ENGG*3450
ENGG*3380	[0.50]	Computer Organization and Design, F (M)	ENGG*2410
ENGG*4080	[0.50]	Analog Integrated Circuits, F (E)	ENGG*3450
ENGG*4430	[0.50]	Neuro-Fuzzy and Soft Computing Systems, W (M)	ENGG*3410; Co-requisite ENGG*4280
ENGG*4460	[0.50]	Robotic Systems, F (M)	ENGG*1500, ENGG*2400
ENGG*4550	[0.50]	VLSI Digital Design, W (E)	ENGG*2410, ENGG*2450, ENGG*3450
ENGG*4660	[0.50]	Medical Image Processing, W (B)	ENGG*3390
BIOM*2000	[0.50]	Concepts in Human Physiology, S/F/W (B)	None
PSYC*2390	[0.50]	Principles of Sensation and Perception, F/W (B)	PSYC*1100
CIS*2750	[0.75]	Software Systems Development and Integration, W (C)	CIS*2430, CIS*2520 Restriction(s): CIS*2450
CIS*3210	[0.50]	Computer Networks, F (C)	CIS*3110; Restriction(s): CIS*4200
CIS*3490	[0.50]	The Analysis and Design of Computer Algorithms, S/W (C)	(CIS*1900 or CIS*2910) , (CIS*2420 or CIS*2520)
CIS*4210	[0.50]	Telecommunications, W (C)	CIS*3210; Restriction(s): CIS*4200

### List ESC-2:

#### ES&C Engineering Design Electives (0.75 Credits)

ENGG*3490	[0.75]	Introduction to Mechatronic Systems Design, W (M)	ENGG*3450; Co-requisite: ENGG*3410 Restriction: ENGG*3400
ENGG*4390	[0.75]	Bio-Instrumentation Design, F (B)	ENGG*3450

### *Conditions for Graduation*

To qualify for the degree, the student must complete the courses required for the Bachelor of Engineering Program in Engineering Systems and Computing, obtaining a minimum of 23.50 credits, and must achieve an overall minimum cumulative average of at least 60% and a minimum cumulative average of at least 60% in all ENGG courses.

**End of engineering systems and computing program requirements for students following the 2008/09 Undergraduate Course Calendar.**

# Engineering Program Guide (Fall 2009- Winter 2010)

# Engineering Program Guide (Fall 2009- Winter 2010)

## Environmental Engineering [Regular and Coop] Schedule of Studies

<b>Semester 1 (Fall) Regular or Co-op</b>		<b>Prerequisites</b>
CHEM*1040	[0.50] General Chemistry I	One of 4U Chemistry, OAC Chemistry (or equivalent), CHEM*1060
CIS*1500	[0.50] Introduction to Programming	None
ENGG*1100	[0.75] Engineering and Design I	None
MATH*1200	[0.50] Calculus I	4U Advanced Functions and Calculus or OAC Calculus
One of:		
ENGG*1210	[0.50] Engineering Mechanics I	None
HIST*1250	[0.50] Science & Society Since 1500	None

<b>Semester 2 (Winter) Regular or Co-op</b>		<b>Prerequisites</b>
CHEM*1050	[0.50] General Chemistry II	CHEM*1040
ENGG*1500	[0.50] Engineering Analysis	Co-requisites ENGG*1210, MATH*1210
MATH*1210	[0.50] Calculus II	1 of MATH*1000, MATH*1080, MATH*1200 (MATH*1200 preferred)
PHYS*1130	[0.50] Physics With Applications	(MATH*1080 or MATH*1200), [1 of 4U Physics, OAC Physics (or equivalent), PHYS*1020]
One of:		
ENGG*1210	[0.50] Engineering Mechanics I	None
HIST*1250	[0.50] Science & Society Since 1500	None

<b>Semester 3 (Fall) Regular or Co-op</b>		<b>Prerequisites</b>
COOP*1100	[0.00] Intro to Co-operative Education	Co-op students only as requirement for entry into the first work term
ENGG*2120	[0.50] Material Science	CHEM*1040, PHYS*1130
ENGG*2400	[0.50] Engineering Systems Analysis	ENGG*1210, ENGG*1500, MATH*1200, MATH*1210, PHYS*1130
MATH*2270	[0.50] Applied Differential Equations	Co-requisite MATH*2270
ELECTIVE	[0.50] Restricted Elective	ENGG*1500, MATH*1210 See elective lists
One of:		
BIOL*1030	[0.50] Biology I [1]	4U Biology (or Grade 12 Biology) strongly recommended
MICR*1020	[0.50] Fundamentals of Applied Microbiology [1]	4U Biology (or Grade 12 Biology) strongly recommended
One of:		
ENGG*2100	[0.75] Engineering and Design II	Completion of 4.0 credits including ENGG*1100
STAT*2120	[0.50] Probability and Statistics for Engineers	1 of MATH*1010, MATH*1210, MATH*2080, IPS*1210

[1] If BIOL\*1030 is chosen instead of MICR\*1020 as the core requirement in Semester 3, then BIOL\*1040 must be taken in Semester 4 as the Environmental Engineering Elective from List ENVE-1. Note that BIOL\*1030 does NOT equate to MICR\*1020. Therefore, BIOL\*1030 alone will not be sufficient to graduate; students must take BIOL\*1040.

If MICR\*1020 is chosen instead of BIOL\*1030 as the core requirement in Semester 3, then BIOL\*1040 is not required in Semester 4. Students may select any Environmental Engineering Elective from List ENVE-1 except BIOL\*1040.

NOTE: BIOL\*1040 is a prerequisite for many science courses in List ENVE-1. Therefore, science choices from List ENVE-1 will be reduced if MICR\*1020 is selected in place of the BIOL\*1030/1040 sequence.

<b>Semester 4 (Winter) Regular or Co-op</b>		<b>Prerequisites</b>
ENGG*2230	[0.50] Fluid Mechanics	ENGG*1210, MATH*1210
ENGG*2450	[0.50] Electric Circuits	ENGG*2400, (PHYS*1010 or PHYS*1130)
ENGG*2560	[0.50] Environmental Engineering Systems	CHEM*1050, MATH*2270
MATH*2130	[0.50] Numerical Methods	MATH*1210 or MATH*2080
One of: see note [1] above		
BIOL*1040	[0.50] Biology II	BIOL*1030
ELECTIVE	[0.50] Restricted Elective if MICR*1020 is selected in Semester 3	See elective lists
One of:		
ENGG*2100	[0.75] Engineering and Design II	Completion of 4.0 credits including ENGG*1100
STAT*2120	[0.50] Probability and Statistics for Engineers	1 of MATH*1010, MATH*1210, MATH*2080, IPS*1210

Schedule of Studies continued on next page...

# Engineering Program Guide (Fall 2009- Winter 2010)

## Environmental Engineering [Regular and Coop] Schedule of Studies

### Semester 5 (Fall) Regular or Co-op

ENGG*3180	[0.50] Air Quality
ENGG*3240	[0.50] Engineering Economics
ENGG*3260	[0.50] Thermodynamics
ENGG*3590	[0.50] Water Quality
ENGG*3650	[0.50] Hydrology

ELECTIVE [0.50] Restricted Elective

### Semester 6 (Winter) Regular or Semester 7 (Winter) Co-op

ENGG\*3100 [0.75] Engineering and Design III

ENGG*3410	[0.50] Systems and Control Theory
ENGG*3430	[0.50] Heat and Mass Transfer
ENGG*3470	[0.50] Mass Transfer Operations
ELECTIVE	[1.00] Restricted Electives

### Semester 7 (Fall) Regular or Semester 6 (Fall) Co-op

ENGG*3670	[0.50] Soil Mechanics
ENGG*4330	[0.75] Air Pollution Control
ENGG*4340	[0.50] Solid & Hazardous Waste Management
ENGG*4370	[0.75] Urban Water Systems Design
ELECTIVE	[0.50] Restricted Elective

### Semester 8 (Winter) Regular or Co-op

ENGG\*4130 [1.00] Environmental Engineering Design IV

ENGG*4260	[0.75] Water & Wastewater Treatment Design
GEOL*3060	[0.50] Groundwater
ELECTIVE	[0.50] Restricted Elective

### Prerequisites

ENGG\*2230, (ENGG\*2560 or ENGG\*2660), Co-requisite ENGG\*3260  
MATH\*1210  
CHEM\*1040, ENGG\*2230, ENGG\*2400, MATH\*2270  
ENGG\*2230, ENGG\*2560, (BIOL\*1040 or MICR\*1020), STAT\*2120  
(ENGG\*2230 or MET\*2030), (MATH\*1210 or MATH\*2080), (STAT\*2120  
or STAT\*2040) and competency in computing  
See elective lists

### Prerequisites

Registration in the B.Eng. program and completion of 6.00 credits of  
ENGG courses including ENGG\*2100  
**Students must have a minimum cumulative average of 60% in all  
ENGG courses for entry into ENGG\*3100. Restriction waiver  
requests are handled by the Director, School of Engineering, or  
designate.**  
ENGG\*2400, MATH\*2270, Co-requisite ENGG\*2450  
ENGG\*2230, ENGG\*3260, MATH\*2270  
ENGG\*2230, ENGG\*3260, MATH\*2270, Co-requisite ENGG\*3430  
See elective lists

### Prerequisites

ENGG\*2120, ENGG\*2230  
ENGG\*3180, ENGG\*3260  
ENGG\*2560 or ENGG\*2660  
ENGG\*2230, ENGG\*3650  
See elective lists

### Prerequisites

All 1000 and 2000 level core credits plus ENGG\*3100. Must be enrolled  
in the B.Eng. Program. This course must be taken in the final semester  
with a maximum of 3.25 credits. Admission to the course is by instructor's  
permission in the semester prior to the course offering.  
**Students must have a minimum cumulative average of 60% in all  
ENGG courses for entry into ENGG\*4130. Restriction waiver  
requests are handled by the Director, School of Engineering, or  
designate.**  
ENGG\*3100, ENGG\*3590  
1 of IPS\*1110, MATH\*1000, MATH\*1080, MATH\*1200  
See elective lists

## *Environmental Engineering Electives*

Environmental engineering students must complete the following restricted electives. You can take these courses where Restricted Electives are indicated in the Schedule of Studies above.

**A maximum of 1.5 credits at the 1000 course level is allowed for elective requirements.**

[1.50] credits in Environmental Engineering Electives in **List ENVE-1**

Note: If BIOL\*1030 is selected instead of MICR\*1020 in Semester 3, then BIOL\*1040 MUST be taken as one of the elective requirements from List ENVE-1.

[2.00] credits in Complementary Studies Electives in **Lists CS-1, CS-2 and CS-3**

(Complementary Studies elective list is located at the back of this program guide)

The Environmental Engineering Elective courses in List ENVE-1 have been organized into areas of emphasis. Students who wish to strengthen their knowledge in a particular area of interest are encouraged to take all 1.5 credits from one section. Students are also free to mix and match courses from more than one area.

# Engineering Program Guide (Fall 2009- Winter 2010)

## Environmental Engineering [Regular and Coop]

Elective courses from List ENVE-1 in combination with elective courses from the Complementary Studies lists may also help students to pursue a minor degree offered by other departments of the University. Please see the Undergraduate Calendar for a listing of minors that are available. If you are interested in obtaining a minor, be sure to check with the engineering program counsellor before you begin selecting elective courses for your environmental engineering major.

Semester offerings for courses may change without notice. Students should refer to the current Undergraduate Calendar to confirm that the course will be offered in the semester indicated in the elective lists within this program guide.

### List ENVE-1: Environmental Engineering Electives (1.5 Credits)

Engineering			
ENGG*2160	[0.50]	Engineering Mechanics II, F	ENGG*1210, ENGG*1500, 0.50 credits in calculus
ENGG*3340	[0.50]	Geographic Information Systems in Environmental Engineering, F	(CIS*1500 or CIS*1600), (1 of MATH*1000, MATH*1080, MATH*1200)
ENGG*3450	[0.50]	Electrical Devices, F	ENGG*2450
ENGG*4250	[0.50]	Watershed Systems Design, W	ENGG*2230, ENGG*3650
ENGG*4280	[0.50]	Digital Processing Control Design, W	ENGG*3410
ENGG*4510	[0.50]	Assessment & Management of Risk, W	STAT*2040 or STAT*2120
Business			
BUS*2220	[0.50]	Financial Accounting, F/W	1 of ECON*1050, ECON*1100, ENGG*3240
BUS*2230	[0.50]	Management Accounting, F/W	AGEC*2220 or BUS*2220
MCS*1000	[0.50]	Introductory Marketing, S/F/W	None
MCS*3000	[0.50]	Advanced Marketing, F	MCS*1000
International Development			
ECON*2650	[0.50]	Introductory Development Economics, F	ECON*1050, ECON*1100
ECON*3720	[0.50]	History of the World Economy Since 1850, U	ECON*1050, ECON*1100, (1 of ECON*2310, EURO*2070, HIST*2450, HUMN*2070, IDEV*2010)
ECON*3730	[0.50]	Europe and the World Economy to 1914, U	ECON*1050, ECON*1100, (1 of ECON*2310, EURO*2070, HIST*2450, HUMN*2070, IDEV*2010)
GEOG*2030	[0.50]	Political Ecology & Geography, F	5.00 credits, GEOG*1220 is recommended
SOAN*3680	[0.50]	Perspectives on Development, F	1 of ANTH*2160, IDEV*2010, SOC*2080
POLS*3670	[0.50]	Comparative Public Policy and Administration, W	1 of IDEV*2010, POLS*2080, POLS*2100, POLS*2250
POLS*3790	[0.50]	The Political Economy of International Relations, W	1 of IDEV*2010, POLS*2080, POLS*2100, POLS*2200
Science			
BIOC*2580	[0.50]	Introductory Biochemistry, S/F/W	CHEM*1050 or CHEM*2300
BIOL*1040	[0.50]	Biology II, F/W	BIOL*1030
BIOL*2060	[0.50]	Ecology, F/W	BIOL*1040
BIOL*3110	[0.50]	Population Ecology, F/W	(MATH*1080 or MATH*1200), STAT*2040
BIOL*3450	[0.50]	Introduction to Aquatic Environments, F/W	BIOL*1040, (CHEM*1050 or CHEM*1310), ZOO*2070 is strongly recommended

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## Engineering Program Guide (Fall 2009- Winter 2010)

### Environmental Engineering [Regular and Coop]

**List ENVE-1 (Continued):  
Environmental Engineering Electives (1.5 Credits)**

Science			
BIOM*2000	[0.50]	Concepts in Human Physiology, S/F/W	None
CHEM*2480	[0.50]	Analytical Chemistry, S/F/W	CHEM*1050 or CHEM*1310
CHEM*2700	[0.50]	Organic Chemistry, S/W	CHEM*1050
CIS*2500	[0.50]	Programming II, W	CIS*1500
CROP*2280	[0.50]	Crops in Land Reclamation, F	None
ENVB*2010	[0.50]	Food Production and the Environment, W	2.50 credits
FOOD*2010	[0.50]	Principle of Food Science, S/W	None
GEOG*1300	[0.50]	Intro to the Biophysical Environment, F/W	None; Restriction: GEOG*1350
OR			
GEOG*1350	[0.50]	Earth: Hazards and Global Change F,W	None; Restriction: GEOG*1300
GEOG*2110	[0.50]	Climate and the Biophysical Environment, W	GEOG*1300 or GEOG*1350
GEOG*2210	[0.50]	Environment & Resources, W	GEOG*1220 is recommended
GEOG*2420	[0.50]	Aerial-Photo Interpretation, F	0.50 credits in geography and/or earth science
GEOL*1100	[0.50]	Principles of Geology, F/W	None
MATH*4430	[0.50]	Advanced Numerical Methods, F	MATH*2130, (MATH*2150 or MATH*2160), MATH*2200, (MATH*2170 or MATH*2270)
MET*2030	[0.50]	Meteorology and Climatology, F	1 of MET*2020, PHYS*1000, PHYS*1070, PHYS*1080, PHYS*1110, PHYS*1130
MICR*2030	[0.50]	Microbial Growth, S/F/W	BIOL*1040
MICR*4180	[0.50]	Microbial Processes in Environmental Management, F	BIOC*2580, BIOL*1040
NRS*2120	[0.50]	Intro to Environmental Stewardship, F	None; Equates: SOIL*2120
NRS*3600	[0.50]	Remote Sensing, W	10.00 credits (recommend: 1 of AGR*2301, AGR*2302, AGR*2320, GEOG*2420, SOIL*2010); Equate: SOIL*3600
POPM*3240	[0.50]	Epidemiology, F	BIOL*1040, STAT*2040
TOX*2000	[0.50]	Principles of Toxicology, F	(CHEM*1050 or CHEM*2300), (MATH*1080 or equivalent), (BIOL*1040 or equivalent) (CHEM*2300 may be taken concurrently)

### *Conditions for Graduation*

To qualify for the degree, the student must complete the courses required for the Bachelor of Engineering Program in Environmental Engineering, obtaining a minimum of 23.50 credits, and must achieve an overall minimum cumulative average of at least 60% and a minimum cumulative average of at least 60% in all ENGG courses.

**End of environmental engineering program requirements for students following the 2008/09 Undergraduate Course Calendar.**

# Engineering Program Guide (Fall 2009- Winter 2010)

## Mechanical Engineering [Regular and Coop] Schedule of Studies

### Semester 1 (Fall) Regular or Co-op

CHEM\*1040 [0.50] General Chemistry I  
 CIS\*1500 [0.50] Introduction to Programming  
 ENGG\*1100 [0.75] Engineering and Design I  
 MATH\*1200 [0.50] Calculus I

One of:

ENGG\*1210 [0.50] Engineering Mechanics I  
 HIST\*1250 [0.50] Science & Society Since 1500

### Prerequisites

One of 4U Chemistry, OAC Chemistry (or equivalent), CHEM\*1060  
 None  
 None  
 4U Advanced Functions and Calculus or OAC Calculus

### Semester 2 (Winter) Regular or Co-op

ENGG\*1500 [0.50] Engineering Analysis  
 MATH\*1210 [0.50] Calculus II  
 PHYS\*1010 [0.50] Introductory Electricity and Magnetism

PHYS\*1130 [0.50] Physics with Applications

One of:

ENGG\*1210 [0.50] Engineering Mechanics I  
 HIST\*1250 [0.50] Science & Society Since 1500

### Prerequisites

Co-requisites ENGG\*1210, MATH\*1210  
 1 of MATH\*1000, MATH\*1080, MATH\*1200 (MATH\*1200 preferred)  
 (MATH\*1080 or MATH\*1200), [1 of 4U Physics, OAC Physics,  
 PHYS\*1020]  
 (MATH\*1080 or MATH\*1200), [1 of 4U Physics, OAC Physics (or  
 equivalent), PHYS\*1020]

### Semester 3 (Fall) Regular or Co-op

COOP\*1100 [0.00] Intro to Co-operative Education  
 ENGG\*2120 [0.50] Material Science  
 ENGG\*2160 [0.50] Engineering Mechanics II  
 ENGG\*2400 [0.50] Engineering Systems Analysis

ENGG\*3240 [0.50] Engineering Economics  
 MATH\*2270 [0.50] Applied Differential Equations

One of:

ENGG\*2100 [0.75] Engineering and Design II  
 STAT\*2120 [0.50] Probability and Statistics for Engineers

### Prerequisites

Co-op students only as requirement for entry into the first work term  
 CHEM\*1040, PHYS\*1130  
 ENGG\*1210, ENGG\*1500, [0.50] credits in Calculus  
 ENGG\*1210, ENGG\*1500, MATH\*1200, MATH\*1210, PHYS\*1130  
 Co-requisite MATH\*2270  
 MATH\*1210  
 ENGG\*1500, MATH\*1210

Completion of 4.0 credits including ENGG\*1100  
 1 of MATH\*1010, MATH\*1210, MATH\*2080, IPS\*1210

### Semester 4 (Winter) Regular or Co-op

ENGG\*2230 [0.50] Fluid Mechanics  
 ENGG\*2340 [0.50] Kinematics and Dynamics  
 ENGG\*2450 [0.50] Electric Circuits  
 MATH\*2130 [0.50] Numerical Methods  
 ELECTIVE [0.50] Restricted Elective

One of:

ENGG\*2100 [0.75] Engineering and Design II  
 STAT\*2120 [0.50] Probability and Statistics for Engineers

### Prerequisites

ENGG\*1210, MATH\*1210  
 ENGG\*2160  
 ENGG\*2400, (PHYS\*1010 or PHYS\*1130)  
 MATH\*1210 or MATH\*2080

See elective lists

Completion of 4.0 credits including ENGG\*1100  
 1 of MATH\*1010, MATH\*1210, MATH\*2080, IPS\*1210

### Semester 5 (Fall) Regular or Co-op

ENGG\*2410 [0.50] Digital Systems Design Using  
 Descriptive Languages  
 ENGG\*3260 [0.50] Thermodynamics  
 ENGG\*3280 [0.50] Machine Design  
 ENGG\*3450 [0.50] Electrical Devices  
 ENGG\*3510 [0.50] Electromechanical Devices  
 ELECTIVE [0.50] Restricted Elective [1]

### Prerequisites

(CIS\*1650 or CIS\*1500), PHYS\*1130  
 CHEM\*1040, ENGG\*2230, ENGG\*2400, MATH\*2270  
 ENGG\*2120, ENGG\*2230, ENGG\*2340, ENGG\*2400, ENGG\*2450  
 ENGG\*2450  
 ENGG\*2160, ENGG\*2450, PHYS\*1010  
 See elective lists

[1] Students planning to take ENGG\*4310 as their MECH-2 design elective in Semester 8, should take ENGG\*2030 as their MECH-1 elective in Semester 5.

Schedule of Studies continued on next page...

# Engineering Program Guide (Fall 2009- Winter 2010)

## Mechanical Engineering [Regular and Coop] Schedule of Studies

### Semester 6 (Winter) Regular or Semester 7 (Winter) Co-op

ENGG\*1070 [0.25] Occupational Health and Safety  
ENGG\*3100 [0.75] Engineering and Design III

### Prerequisites

10.00 credits, must be enrolled in B.Eng. Program.  
Registration in the B.Eng. program and completion of 6.00 credits of ENGG courses including ENGG\*2100  
**Students must have a minimum cumulative average of 60% in all ENGG courses for entry into ENGG\*3100. Restriction waiver requests are handled by the Director, School of Engineering, or designate.**

ENGG\*3370 [0.50] Applied Fluids and Thermodynamics  
ENGG\*3410 [0.50] Systems and Control Theory  
ENGG\*3430 [0.50] Heat and Mass Transfer  
ELECTIVE [0.50] Restricted Electives [2]

ENGG\*2230, ENGG\*3260, co-requisite ENGG\*3430  
ENGG\*2400, MATH\*2270, co-requisite ENGG\*2450  
ENGG\*2230, ENGG\*3260, MATH\*2270

See elective lists

[2] *Students planning to take ENGG\*4030 as their MECH-2 design elective in Semester 8, should take ENGG\*3070 as their MECH-1 elective in Semester 6.*  
*Students planning to take ENGG\*4310 as their MECH-2 design elective in Semester 8, should take ENGG\*2050 as their MECH-1 elective in Semester 6.*  
*Students planning to take ENGG\*4480 as their MECH-2 design elective in Semester 8, should take ENGG\*3490 as their MECH-1 elective in Semester 6.*

### Semester 7 (Fall) Regular or Semester 6 (Fall) Co-op

ELECTIVE [2.50] or [2.75] Restricted Electives [3]

### Prerequisites

See elective lists

[3] *Students planning to take ENGG\*4030 as their MECH-2 design elective in Semester 8, should take ENGG\*3120 and ENGG\*4460 as their MECH-1 electives in Semester 7.*  
*Students planning to take ENGG\*4400 as their MECH-2 design elective in Semester 8, should take ENGG\*3170 as their MECH-1 elective in Semester 7.*  
*Students planning to take ENGG\*4480 as their MECH-2 design elective in Semester 8, should take ENGG\*3640 and ENGG\*4460 as their MECH-1 electives in Semester 7.*

### Semester 8 (Winter) Regular or Co-op

ENGG\*4160 [1.00] Mechanical Engineering Design IV

### Prerequisites

All 1000 and 2000 level core credits plus ENGG\*3100. Must be enrolled in the B.Eng. Program. This course must be taken in the final semester with a maximum of 3.25 credits. Admission to the course is by instructor's permission in the semester prior to the course offering.  
**Students must have a minimum cumulative average of 60% in all ENGG courses for entry into ENGG\*4160. Restriction waiver requests are handled by the Director, School of Engineering, or designate.**

ELECTIVE [2.00] or [2.25] Restricted Electives [4]

See elective lists

[4] *Students planning to take ENGG\*4030 as their MECH-2 design elective in Semester 8, should take ENGG\*4050 and ENGG\*4280 as their MECH-1 electives in Semester 8.*  
*Students planning to take ENGG\*4310 as their MECH-2 design elective in Semester 8, should take ENGG\*4280 and ENGG\*4430 as their MECH-1 electives in Semester 8.*  
*Students planning to take ENGG\*4480 as their MECH-2 design elective in Semester 8, should take ENGG\*4430 as their MECH-1 elective in Semester 8.*

# Engineering Program Guide (Fall 2009- Winter 2010)

## Mechanical Engineering [Regular and Coop]

### *Mechanical Engineering Restricted Electives*

Mechanical Engineering students must complete the following restricted electives. You can take these courses where restricted electives are indicated in the Schedule of Studies above.

**A maximum of 1.5 credits at the 1000 course level is allowed for elective requirements.**

- [3.50] credits in Mechanical Engineering Electives in **List MECH-1**
- [0.75] credits in Mechanical Engineering Design Electives in **List MECH-2**
- [2.00] credits in Complementary Studies electives in **Lists CS-1, CS-2 and CS-3**  
(Complementary Studies elective list is located at the back of this program guide)

The restricted elective requirements in the Mechanical Engineering program have been designed to allow students to develop a broad foundation in mechanical engineering topics, or to focus on a specific area of interest. Students who seek a broadening approach are encouraged to select **ENGG\*4220 Interdisciplinary Mechanical Engineering Design** from List MECH-2 in the final semester of their program.

Students who seek a more specialized approach are encouraged to select one of the specialized design elective courses from List MECH-2. It is important to note that some of the prerequisite course requirements for the specialized design electives are included in the Engineering Elective List MECH-1. These courses must be taken to gain registration access to the design elective course. The following table provides guidance for selecting elective courses from MECH-1 associated with each of the specialized design electives.

### **Suggested Elective Course Sequencing**

List MECH-2 Chose ENGG*4220, Or one of:	List MECH-1 Suggested Elective Sequence for prerequisites and co-requisites
ENGG*4030 (Semester 8) Manufacturing Systems Design	ENGG*3070 (Semester 6) ENGG*3120 (Semester 7) ENGG*4460 (Semester 7) ENGG*4050 (Semester 8) ENGG*4280 (Semester 8)
ENGG*4310 (Semester 8) Wind and Solar Energy	ENGG*2030 (Semester 5) ENGG*2050 (Semester 6) ENGG*4350 (Semester 8)
ENGG*4400 (Semester 7) Biomechanical Engineering Design	ENGG*3170 (Semester 7)
ENGG*4480 (Semester 8) Advanced Mechatronic System Design	ENGG*3490 (Semester 6) ENGG*3640 (Semester 7) ENGG*4460 (Semester 7) ENGG*4430 (Semester 8)

All elective course offerings are subject to a minimum enrolment of 10 students. Courses may be cancelled by the university at any time if enrolment is less than 10. Semester offerings for courses may change without notice. Students should refer to the current Undergraduate Calendar to confirm that the course will be offered in the semester indicated in the elective lists within this program guide.

# Engineering Program Guide (Fall 2009- Winter 2010)

## Mechanical Engineering [Regular and Coop]

### List MECH-1:

#### Mechanical Engineering Electives (3.50 Credits)

ENGG*2030	[0.50]	Traditional Energy Sources, W	CHEM*1040, ENGG*2120
ENGG*2050	[0.75]	Emerging Energy Systems, W	ENGG*2030, PHYS*1010
ENGG*3030	[0.50]	Energy Distribution, F	ENGG*2030, ENGG*2450, ENGG*3240, ENGG*3410
ENGG*3070	[0.50]	Integrated Manufacturing Systems, W	ENGG*2120, ENGG*2450, Co-requisite: ENGG*3410
ENGG*3120	[0.75]	CAD/CAM, W	ENGG*2100, ENGG*3280
ENGG*3150	[0.50]	Biomechanics, W	ENGG*2160
ENGG*3170	[0.50]	Biomaterials, F	ENGG*2120
ENGG*3390	[0.50]	Signal Processing, F	ENGG*2400
ENGG*3490	[0.75]	Introduction to Mechatronic Systems Design, W	ENGG*3450, Co-requisite: ENGG*3410
ENGG*3640	[0.50]	Microcomputer Interfacing, F	Currently: ENGG*2410, Co-requisite: ENGG*3390 <i>(proposed change effective F10):</i> <b>ENGG*2410, ENGG*2450</b>
ENGG*4050	[0.50]	Quality Control, W	Currently: ENGG*3070, STAT*2120 <i>(proposed change effective F10)</i> <b>STAT*2120</b>
ENGG*4280	[0.75]	Digital Process Control Design, W	ENGG*3410
ENGG*4350	[0.50]	Energy Economics, W	ENGG*2050, ENGG*3240
ENGG*4430	[0.50]	Neuro-Fuzzy and Soft Computing Systems, W	ENGG*3410; Co-requisite ENGG*4280
ENGG*4440	[0.50]	Computational Fluid Dynamics, F	ENGG*2230, ENGG*3370
ENGG*4460	[0.50]	Robotic Systems, F	ENGG*1500, ENGG*2400
ENGG*4470	[0.50]	Finite Element Analysis, F	ENGG*2340, MATH*2130, MATH*2270
ENGG*4510	[0.50]	Assessment and Management of Risk, W	STAT*2040 or STAT*2120
ENGG*4660	[0.50]	Medical Image Processing, W	ENGG*3390

### List MECH-2:

#### Mechanical Engineering Design Electives (0.75 Credits)

ENGG*4030	[0.75]	Manufacturing Systems Design, W	ENGG*3070, ENGG*3120, ENGG*3510, ENGG*4460 Co-requisites: ENGG*4050, ENGG*4280
ENGG*4220	[0.75]	Interdisciplinary Mechanical Engineering Design, W	ENGG*3100
ENGG*4310	[0.75]	Wind and Solar Energy, W	ENGG*2050, ENGG*2450, ENGG*3100 Co-requisite: ENGG*4350
ENGG*4400	[0.75]	Biomechanical Engineering Design, F	ENGG*2120, Co-requisite: ENGG*3170
ENGG*4480	[0.75]	Advanced Mechatronic System Design, W	ENGG*3490, ENGG*3640, ENGG*4460 Co-requisite: ENGG*4430 Restriction: ENGG*4280

## Engineering Program Guide (Fall 2009- Winter 2010)

### Mechanical Engineering [Regular and Coop]

#### *Conditions for Graduation*

To qualify for the degree, the student must complete the courses required for the Bachelor of Engineering Program in Mechanical Engineering, obtaining a minimum of 23.50 credits, and must achieve an overall minimum cumulative average of at least 60% and a minimum cumulative average of at least 60% in all ENGG courses.

**End of mechanical engineering program requirements for students following the 2009/10 Undergraduate Course Calendar.**

## Engineering Program Guide (Fall 2009- Winter 2010)

# Engineering Program Guide (Fall 2009- Winter 2010)

## Water Resources Engineering [Regular and Coop] Schedule of Studies

### Semester 1 (Fall) Regular or Co-op

CHEM*1040	[0.50] General Chemistry I
CIS*1500	[0.50] Introduction to Programming
ENGG*1100	[0.75] Engineering and Design I
MATH*1200	[0.50] Calculus I

One of:

ENGG*1210	[0.50] Engineering Mechanics I
HIST*1250	[0.50] Science & Society Since 1500

### Prerequisites

one of 4U Chemistry, OAC Chemistry (or equivalent), CHEM\*1060  
None  
None  
4U Advanced Functions and Calculus or OAC Calculus

### Semester 2 (Winter) Regular or Co-op

CHEM*1050	[0.50] General Chemistry II
ENGG*1500	[0.50] Engineering Analysis
MATH*1210	[0.50] Calculus II
PHYS*1130	[0.50] Physics With Applications

One of:

ENGG*1210	[0.50] Engineering Mechanics I
HIST*1250	[0.50] Science & Society Since 1500

### Prerequisites

CHEM\*1040  
Co-requisites ENGG\*1210, MATH\*1210  
1 of MATH\*1000, MATH\*1080, MATH\*1200 (MATH\*1200 preferred) (MATH\*1080 or MATH\*1200), [1 of 4U Physics, OAC Physics (or equivalent), PHYS\*1020]

### Semester 3 (Fall) Regular or Co-op

COOP*1100	[0.00] Intro to Co-operative Education
ENGG*2120	[0.50] Material Science
ENGG*2400	[0.50] Engineering Systems Analysis
GEOG*2000	[0.50] Geomorphology [1]
MATH*2270	[0.50] Applied Differential Equations
MICR*1020	[0.50] Fundamentals of Applied Microbiology [2]

One of:

ENGG*2100	[0.75] Engineering and Design II
STAT*2120	[0.50] Probability and Statistics for Engineers

### Prerequisites

Co-op students only as requirement for entry into the first work term  
CHEM\*1040, PHYS\*1130  
ENGG\*1210, ENGG\*1500, MATH\*1200, MATH\*1210, PHYS\*1130  
Co-requisite MATH\*2270  
1 of GEOG\*1300, GEOG\*1350, GEOL\*1050, GEOL\*1100  
ENGG\*1500, MATH\*1210  
4U Biology (or Grade 12 Biology) strongly recommended

Completion of 4.0 credits including ENGG\*1100  
1 of MATH\*1010, MATH\*1210, MATH\*2080, IPS\*1210

[1] WRE students are permitted to take GEOG\*2000 without completing the prerequisite. However, Webadvisor will not allow you to register for GEOG\*2000 if you have not completed the prerequisite. A prerequisite waiver form may be obtained from the Undergraduate Services on the 3<sup>rd</sup> floor of the UC and must be signed by either the course instructor or engineering program counsellor, when designated.

[2] WRE students wishing to take BIOL\*1030 in place of MICR\*1020 will be permitted to do so. Please inform your program counsellor. Note that BIOL\*1030 does NOT equate to MICR\*1020. Therefore, BIOL\*1030 alone will not be sufficient to graduate; students must also take BIOL\*1040.

If BIOL\*1030 is chosen in lieu of MICR\*1020, then BIOL\*1040 must be taken as a List WRE-2, Environmental Resources elective or for "extra" credit. BIOL\*1040 is a prerequisite for several List WRE-2 elective courses.

### Semester 4 (Winter) Regular or Co-op

ENGG*2230	[0.50] Fluid Mechanics
ENGG*2450	[0.50] Electric Circuits
ENGG*2550	[0.50] Water Management
ENGG*2560	[0.50] Environmental Engineering Systems
MATH*2130	[0.50] Numerical Methods

One of:

ENGG*2100	[0.75] Engineering and Design II
STAT*2120	[0.50] Probability and Statistics for Engineers

### Prerequisites

ENGG\*1210, MATH\*1210  
ENGG\*2400, (PHYS\*1010 or PHYS\*1130)  
(CHEM\*1040 or CHEM\*1310), GEOG\*2000  
CHEM\*1050, MATH\*2270  
MATH\*1210 or MATH\*2080

Completion of 4.0 credits including ENGG\*1100  
1 of MATH\*1010, MATH\*1210, MATH\*2080, IPS\*1210

Schedule of Studies continued on next page...



# Engineering Program Guide (Fall 2009- Winter 2010)

## Water Resources Engineering [Regular and Coop] Schedule of Studies

### Semester 5 (Fall) Regular or Co-op

ENGG\*3240 [0.50] Engineering Economics  
ENGG\*3260 [0.50] Thermodynamics  
ENGG\*3590 [0.50] Water Quality  
ENGG\*3650 [0.50] Hydrology

ENGG\*3670 [0.50] Soil Mechanics  
ELECTIVE [0.50] Restricted Elective

### Semester 6 (Winter) Regular or Semester 7 (Winter) Co-op

ENGG\*3100 [0.75] Engineering and Design III

ENGG\*3430 [0.50] Heat and Mass Transfer  
GEOL\*3060 [0.50] Groundwater  
ELECTIVE [1.50] Restricted Electives [3]

### Semester 7 (Fall) Regular or Semester 6 (Fall) Co-op

ENGG\*3340 [0.50] Geographic Information Systems in  
Environmental Engineering  
ENGG\*4360 [0.75] Soil-Water Conservation Systems Design  
ENGG\*4370 [0.75] Urban Water Systems Design  
ELECTIVE [1.00] Restricted Elective

### Semester 8 (Winter) Regular or Co-op

ENGG\*4150 [1.00] Water Resources Engineering Design IV

ENGG\*4250 [0.75] Watershed Systems Design [3]  
ELECTIVE [1.00] Restricted Electives

### Prerequisites

MATH\*1210  
CHEM\*1040, ENGG\*2230, ENGG\*2400, MATH\*2270  
ENGG\*2230, ENGG\*2560, (BIOL\*1040 or MICR\*1020), STAT\*2120  
(ENGG\*2230 or MET\*2030), (MATH\*1210 or MATH\*2080),  
(STAT\*2120 or STAT\*2040) and competency in computing  
ENGG\*2120, ENGG\*2230  
See elective lists

### Prerequisites

Registration in the B.Eng. program and completion of 6.00 credits of  
ENGG courses including ENGG\*2100

Students must have a minimum cumulative average of 60% in all  
ENGG courses for entry into ENGG\*3100. Restriction waiver  
requests are handled by the Director, School of Engineering, or  
designate.

ENGG\*2230, ENGG\*3260, MATH\*2270  
1 of IPS\*1110, MATH\*1000, MATH\*1080, MATH\*1200

See elective lists

### Prerequisites

(CIS\*1500 or CIS\*1600), (1 of MATH\*1000, MATH\*1080, MATH\*1200)

ENGG\*2230, ENGG\*3650, ENGG\*3670  
ENGG\*2230, ENGG\*3650

See elective lists

### Prerequisites

All 1000 and 2000 level core credits plus ENGG\*3100. Must be  
enrolled in the B.Eng. Program. This course must be taken in the final  
semester with a maximum of 3.25 credits. Admission to the course is  
by instructor's permission in the semester prior to the course offering.  
Students must have a minimum cumulative average of 60% in all  
ENGG courses for entry into ENGG\*4150. Restriction waiver  
requests are handled by the Director, School of Engineering, or  
designate.

ENGG\*2230, ENGG\*3650

See elective lists

[3] ENGG\*4250 can also be taken in Semester 6 Regular or Semester 7 Co-op if students prefer to take electives in Semester 8.

### *Water Resources Engineering Electives*

Water resources engineering students must complete the following restricted electives. You can take these courses where Restricted Electives are indicated in the Schedule of Studies above.

**A maximum of 1.5 credits at the 1000 course level is allowed for elective requirements.**

- [1.00] credits in Water Resources Engineering Electives in **List WRE-1**
- [0.50] credits in Environmental Resources Elective in **List WRE-2**
- [0.50] credits in Water Resources Elective in **List WRE-3**
- [2.00] credits in Complementary Studies Electives in Lists **CS-1, CS-2 and CS-3**  
(Complementary Studies elective list is located at the back of this program guide)

# Engineering Program Guide (Fall 2009- Winter 2010)

## Water Resources Engineering [Regular and Coop]

Semester offerings for courses may change without notice. Students should refer to the current Undergraduate Calendar to confirm that the course will be offered in the semester indicated in the elective lists within this program guide.

### List WRE-1:

#### Water Resources Engineering Electives (1.0 Credit)

ENGG*3410 [0.50]	Systems and Control Theory, W	ENGG*2400, MATH*2270 Co-requisite ENGG*2450
ENGG*3450 [0.50]	Electrical Devices, F	ENGG*2450
ENGG*4260 [0.75]	Water and Wastewater Treatment, W	ENGG*3100, ENGG*3590
ENGG*4340 [0.50]	Solid & Hazardous Waste Management, F	ENGG*2560 or ENGG*2660
ENGG*4510 [0.50]	Assessment & Management of Risk, W	STAT*2040 or STAT*2120

### List WRE-2:

#### Environmental Resources Electives (0.50 Credits)

BIOL*1020 [0.50]	Introduction to Biology, F	None
BIOL*1040 [0.50]	Biology II, F/W <sup>1</sup>	BIOL*1030
BIOL*2060 [0.50]	Ecology, F/W <sup>2</sup>	BIOL*1040
BIOL*3450 [0.50]	Introduction to Aquatic Environments, F/W <sup>3</sup>	BIOL*1040, (CHEM*1050 or CHEM*1310), ZOO*2070 is strongly recommended
CHEM*3360 [0.50]	Environmental Chemistry and Toxicology, S/W	CHEM*1050; Equates: TOX*3360
GEOG*1300 [0.50]	Introduction to the Biophysical Environment, F/W	None; Restriction: GEOG*1350
GEOG*3210 [0.50]	Management of the Biophysical Environment, F <sup>4</sup>	7.50 credits including (ENVS*2010 or GEOG*2210)
GEOG*4210 [0.50]	Environmental Governance, F	GEOG*3210
MICR*4180 [0.50]	Microbial Processes in Environmental Management, F <sup>5</sup>	BIOC*2580, BIOL*1040

### List WRE-3:

#### Water Resources Electives (0.50 Credits)

GEOG*2420 [0.50]	Aerial-photo Interpretation, F	0.50 credit in geography and/or earth science
GEOG*2480 [0.50]	Mapping and GIS, F/W	5.00 credits
GEOG*3000 [0.50]	Fluvial Processes, F	GEOG*2000, (GEOG*2460 or STAT*2040)
GEOG*4150 [0.50]	Sedimentary Processes, W	GEOG*3000

Table continued on next page...

<sup>1</sup> Students taking BIOL\*1040 will need to take BIOL\*1030 in place of MICR\*1020 in Semester 3.

<sup>2</sup> Students wishing to take BIOL\*2060 will require BIOL\*1040 as a prerequisite. One of these two courses will not count toward their degree, but will be included on their transcript as an extra course.

<sup>3</sup> Students wishing to take BIOL\*3450 will require BIOL\*1040 as a prerequisite. One of these two courses will not count toward their degree, but will be included on their transcript as an extra course.

<sup>4</sup> The prerequisite, GEOG\*2210 can be taken as part of the Complementary Studies elective requirement.

<sup>5</sup> Students wishing to take MICR\*4180 will require BIOC\*2580 and BIOL\*1040 as a prerequisite, neither of which will count toward their degree, but will be included on their transcript as an extra course.

## Engineering Program Guide (Fall 2009- Winter 2010)

### Water Resources Engineering [Regular and Coop]

**List WRE-3(Continued):**

**Water Resources Electives (0.50 Credits)**

GEOL*1100	[0.50]	Principles of Geology, S/F/W	None
GEOL*2200	[0.50]	Glacial Geology with lab, W; OR	1 of AGR*2301, AGR*2320, GEOG*1300, GEOL*1050,
GEOL*2160	[0.50]	Glacial Geology no lab, W	GEOL*1100, SOIL*2010, SOIL*2200
GEOL*3190	[0.50]	Environmental Water Chemistry, F	1 of CHEM*1010, CHEM*1050, CHEM*1310
MET*2020	[0.50]	Agrometeorology, W	BIOL*1020 or BIOL*1030
MET*2030	[0.50]	Meteorology and Climatology, F	1 of MET*2020, PHYS*1000, PHYS*1070, PHYS*1080, PHYS*1110, PHYS*1130,
NRS*3100	[0.50]	Resource Planning Techniques, W	SOIL*3050; Equates: SOIL*3100
NRS*3600	[0.50]	Remote Sensing, W	10.00 credits (recommend: 1 of AGR*2301, AGR*2302, AGR*2320, GEOG*2420, SOIL*2010; Equates: SOIL*3600
SOIL*2010	[0.50]	Soil Science, W	None
SOIL*3050	[0.50]	Land Utilization, F	1 of AGR*2301/2, AGR*2320, GEOG*1300, GEOL*1000, SOIL*2010
SOIL*3070	[0.50]	Environmental Soil Physics, F	1 of MATH*1080, AGR*2301/2, AGR*2320, SOIL*2010

### *Conditions for Graduation*

To qualify for the degree, the student must complete the courses required for the Bachelor of Engineering Program in Water Resources Engineering, obtaining a minimum of 23.50 credits, and must achieve an overall minimum cumulative average of at least 60% and a minimum cumulative average of at least 60% in all ENGG courses.

**End of water resources engineering program requirements for students following the 2008/09 Undergraduate Course Calendar.**

# Engineering Program Guide (Fall 2009- Winter 2010)

## Complementary Studies Electives

Professional engineers often face complex situations involving sociological, political and economic factors in addition to technical and technological problems. Recognition of the human aspects is so important that special attention should be paid to the humanities, social sciences and to areas of administrative studies. As an engineering student at the University of Guelph, you should strive to become aware of the role of professional engineers in society and the contribution engineering makes to the economic, social and cultural aspirations of society. In the Complementary Studies elective courses, along with ENGG\*3240 Engineering Economics and HIST\*1250 Science & Society Since 1500 in the core curriculum, you should gain an understanding of:

- The nature of the human and natural environment and the impact of technology on it;
- The function and roles of individuals, organizations, business and governments in shaping our society and its values;
- The ethical and legal responsibilities, guidelines and constraints within which the engineering profession functions, and;
- Effective communication within the profession and society at large.

The term “complementary” in the context of CEAB requirements **does not mean** “related to or relevant to my engineering major”. These electives are meant to broaden your knowledge and understanding of issues not directly related to technology or science, but that can be **impacted** by them.

Your selection of complementary studies elective courses should be considered with regard to both personal interest and career aspirations so as to ensure that some maturity is attained in the elective area of study. Advice may be obtained from Program Counsellors in each of the Departments and Schools of the University.

**B.Eng. students must select [2.00] credits (four courses) from the Complementary Studies electives in the Lists provided below. You must select one course from each of the three sub-lists (CS-1, CS-2 and CS-3) and the fourth course from any one of the sub-lists.**

Students should refer to Course Descriptions in the current Undergraduate Calendar for prerequisites, class hours and the semester(s) in which courses are offered.

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c12/index.shtml>.

It is the responsibility of each student to contact the relevant department to check the flexibility of the prerequisites and course availability. Prerequisite waivers are at the discretion of the course instructor only.

### List CS-1: Central Issues

AGEC*1300	[0.50] Food, Poverty and Hunger, W
EDRD*4020	[0.50] Rural Extension in Change and Development, F
GEOG*1200	[0.50] Society and Space, F/W
GEOG*1220	[0.50] Human Impact on the Environment, F/W
GEOG*2210	[0.50] Environment and Resources, W
GEOG*3020	[0.50] Global Environmental Change, F
GEOG*3050	[0.50] Development and the City, W
GEOG*3210	[0.50] Management of the Biophysical Environment, F
ISS*2500	[0.50] Management in Organizations, W
POLS*1500	[0.50] World Politics, F
POLS*2080	[0.50] Development and Underdevelopment, F
POLS*2200	[0.50] International Relations and Governance, F
POLS*2250	[0.50] Public Administration, W
POLS*2300	[0.50] Canadian Government, F/W
POLS*3060	[0.50] Politics of the Middle East and North Africa, U
POLS*3080	[0.50] Politics of Latin America, U
POLS*3110	[0.50] Politics of Ontario, U
POLS*3250	[0.50] Public Policy: Challenges and Prospects, F
POLS*3270	[0.50] Local Government in Ontario, U

## Engineering Program Guide (Fall 2009- Winter 2010)

### List CS-2: Methodologies

AGEC*2700	[0.50] Survey of Natural Resource Economics, F
AGEC*4360	[0.50] Marketing Research, W
BUS*2220	[0.50] Financial Accounting, F/W
BUS*2230	[0.50] Management Accounting, F/W
ECON*1050	[0.50] Introductory Microeconomics, S/F/W
ECON*1100	[0.50] Introductory Macroeconomics, S/F/W
ECON*2000	[0.50] Economic Problems in Canada, U
ECON*2100	[0.50] Economic Growth and Environmental Quality, F
ECON*2200	[0.50] Industrial Relations, F
ECON*2310	[0.50] Intermediate Microeconomics, S/F/W
ECON*2410	[0.50] Intermediate Macroeconomics, S/F/W
EDRD*3000	[0.50] Program Development and Evaluation, W
EDRD*3140	[0.50] Organizational Communication, S
EDRD*3160	[0.50] International Communication, W
EDRD*3550	[0.50] Economic Development for Rural and Smaller Communities, S
EDRD*4120	[0.50] Leadership Development in Small Organizations, F
HTM*2150	[0.50] Introduction to Canadian Business Management, U
MCS*1000	[0.50] Introductory Marketing, S/F/W
MCS*2600	[0.50] Fundamentals of Consumer Behaviour, F/W
MCS*3010	[0.50] Quality Management, W
MCS*3040	[0.50] Business and Consumer Law, S/F/W
NRS*2120	[0.50] Introduction to Environmental Stewardship; (Equates SOIL*2120), F
POLS*1400	[0.50] Issues in Canadian Politics, F
POLS*3370	[0.50] Environmental Politics and Governance, S/F

### List CS-3: Social Sciences

ANTH*1150	[0.50] Introduction to Anthropology, S/F/W
ANTH*2160	[0.50] Social Anthropology, W
ANTH*3400	[0.50] The Anthropology of Gender, W
ARTH*XXXX	All Art History courses
ECON*3720	[0.50] History of the World Economy Since 1850, U
ECON*3730	[0.50] Europe and the World Economy to 1914, U
ENGL*1200	[0.50] Reading the Contemporary World, F/W
ENGL*1410	[0.50] Major Writers, U
ENGL*2200	[0.50] Postcolonial Literatures, U
FREN*2020	[0.50] France: Literature and Society, F/W
FREN*2060	[0.50] Québec: Literature and Society, F/W
FRHD*1010	[0.50] Human Development, W
GERM*2240	[0.50] Germany Through the Ages, W
GERM*2590	[0.50] Classics of German Literature, F
HIST*XXXX	All History courses
ISS*3420	[0.50] Women Social and Political Theorists, W
MUSC*2620	[0.50] Music History: Classical and Romantic Eras, F
NUTR*1010	[0.50] Nutrition and Society, F/W
PHIL*1000	[0.50] Introductory Philosophy: Major Texts, F/W
PHIL*1010	[0.50] Introductory Philosophy: Social and Political Issues, F/W
PHIL*1050	[0.50] Introductory Philosophy: Basic Problems, F/W
PHIL*2030	[0.50] Philosophy of Medicine, F/W
PHIL*2060	[0.50] Philosophy of Feminism I, W
PHIL*2070	[0.50] Philosophy of the Environment, W
PHIL*2100	[0.50] Critical Thinking, F/W
PHIL*2120	[0.50] Ethics, F/W
PHIL*2130	[0.50] Philosophy of Religion, F
PHIL*2180	[0.50] Philosophy of Science, F
PHIL*3230	[0.50] Issues in Social and Political Philosophy, W
PSYC*1100	[0.50] Principles of Behaviour, S/F/W
PSYC*1200	[0.50] Dynamics of Behaviour, S/F/W
PSYC*2310	[0.50] Intro to Social Psychology, S/F/W
PSYC*2330	[0.50] Principles of Learning, F/W

List CS-3 continued on next page...

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### List CS-3: Social Sciences (Continued)

SOC*1100	[0.50] Sociology, S/F/W
SOC*2010	[0.50] Canadian Society, U
SOC*2070	[0.50] Social Deviance, S/F/W
SOC*2080	[0.50] Rural Sociology, W
SOC*2280	[0.50] Society and Environment, U
SOC*3380	[0.50] Society and Nature, U
SOC*3410	[0.50] Individual and Society, U
WMST*XXXX	All Women's Studies courses
UNIV*3250	[0.50] Environmental Perspectives and Human Choices II, W

# Engineering Program Guide (Fall 2009- Winter 2010)

## Engineering Minors

You must be registered in the B.Eng. program to take either of the Engineering Minor programs. Declaration of these minors must be done prior to entering Semester 6 [Regular] or Semester 7 [Coop] because ENGG\*3100 and your final design project (ENGG\*41X) will require the application of both your minor and major programs. In addition, you must notify the course instructor of ENGG\*3100 and your final design (41X) advisor that you are enrolled in an Engineering Minor within the first week of classes.

**Courses that you take for the minors will be counted towards the appropriate elective areas in your major program.**

### Environmental Engineering Minor

A minor in Environmental Engineering may be obtained by taking additional courses:	Prerequisites
BIOC*2580 [0.50] Introductory Biochemistry	CHEM*1050 or CHEM*2300
CHEM*3360 [0.50] Environmental Chemistry and Toxicology	CHEM*1050; Equates: TOX*3360
ENGG*3180 [0.50] Air Quality	ENGG*2230, (ENGG*2560 or ENGG*2660), Co-requisite ENGG*3260
ENGG*3590 [0.50] Water Quality	ENGG*2230, ENGG*2560, (BIOL*1040 or MICR*1020), STAT*2120
ENGG*4260 [0.75] Water and Wastewater Treatment Design	ENGG*3100, ENGG*3590
GEOG*1300 [0.50] Intro to the Biophysical Environment	None
MICR*1020 [0.50] Fundamentals of Applied Microbiology	4U Biology (or Grade 12 Biology) strongly recommended
MICR*4180 [0.50] Microbial Processes in Environmental Management	BIOC*2580, BIOL*1040
One of:	
ENGG*2560 [0.50] Environmental Engineering Systems	CHEM*1050, MATH*2270
ENGG*2660 [0.50] Biological Engineering Systems	ENGG*2400, MATH*2270, MICR*1020, Co-requisite BIOC*2580
One of:	
ENGG*3470 [0.50] Mass Transfer Operations	ENGG*2230, ENGG*3260, MATH*2270, Co-requisite ENGG*3430
ENGG*4330 [0.75] Air Pollution Control	ENGG*3180, ENGG*3260
ENGG*4340 [0.50] Solid & Hazardous Waste Management	ENGG*2560 or ENGG*2660

**You must select an environmental application for your final design project in your major program.**

### Food Engineering Minor

A minor in Food Engineering may be obtained by taking additional courses:	Prerequisites
BIOC*2580 [0.50] Introductory Biochemistry	CHEM*1050 or CHEM*2300
BUS*2220 [0.50] Financial Accounting	1 of ECON*1050, ECON*1100, ENGG*3240
ENGG*2660 [0.50] Biological Engineering Systems I	ENGG*2400, MATH*2270, MICR*1020, Co-requisite BIOC*2580
ENGG*3830 [0.50] Bio-Process Engineering	ENGG*2230, ENGG*2660, Co-requisite ENGG*3260
FOOD*2150 [0.50] Intro to Nutritional and Food Sciences	BIOL*1040, (CHEM*1040 or CHEM*1300); Equates: NUTR*2150
MICR*1020 [0.50] Fundamentals of Applied Microbiology	4U Biology (or Grade 12 Biology) strongly recommended
One Of:	
ENGG*4300 [0.75] Food Processing Engineering Design	ENGG*3260, ENGG*3830
ENGG*4380 [0.75] Bio Reactor Design	ENGG*3160
Two of:	
FOOD*4070 [0.50] Food Packaging	8.00 credits in science or engineering or (FOOD*2010, FOOD*2410, FOOD*2420)
FOOD*4110 [0.50] Meat and Poultry Processing	1 of ANSC*2340, FOOD*3090, FOOD*3160
MCS*3010 [0.50] Quality Management	10.00 credits including [0.50] credits in statistics; Equates: COST*3010
One of:	
FOOD*3160 [0.75] Food Processing I	(FOOD*2620, MICR*2030) or ENGG*2660
FOOD*4520 [0.50] Utilization of Cereal Grains for Human Food	BIOC*2580, BIOL*1040
One of:	
FOOD*2400 [0.50] Introduction to Food Chemistry	CHEM*1040
FOOD*3030 [0.50] Food Chemistry I	BIOC*2580
FOOD*3230 [0.75] Food Microbiology	MICR*1020 or MICR*2030
FOOD*3260 [0.50] Industrial Microbiology	1 of MICR*1020, MICR*2020, MICR*2030

**You must select a food application project for your final design project in your major program.**