X—Degree Programs, Bachelor of Science in Engineering [B.Sc.(Eng.)]

Program Information

Objectives of the Program

Students in this program obtain a liberal engineering education, which enables them to undertake the solution of engineering problems of the biological world and the associated environment of soil, water and atmosphere. Core subjects, combined with elective opportunities, gives an understanding of the interactions between the environment and human activity. This understanding of the environment is used to develop capability to design systems, structures and machines to operate within the environment.

Concern over both urban and rural environment provides challenges for engineers to optimize the use made of air, water and land for the community at large. Career opportunities are open in many segments of the economy. Examples are: consulting services to municipalities, utilities and industry; resource agencies in advisory, regulatory, planning and utilization; service industries of construction, power and water supply and public health; industrial and agricultural production, design of computer and control systems for processing, storage and transportation.

Many engineers assume management responsibilities after gaining experience in design, development and operations. The liberal education in life, computational, earth or biological sciences in addition to the social sciences and arts prepares students for career mobility.

Accreditation

The baccalaureate degree programs in all engineering programs are accredited by the Canadian Engineering Accreditation Board of the Canadian Council of Professional Engineers. Graduates from accredited engineering programs have the educational requirements to apply for membership in the Professional Engineers, Ontario (PEO) and other provinces after a number of years of acceptable engineering experience and successful completion of a PEO examination in engineering law and ethics.

Requirements of the Program

Students combine their required courses in mathematics, physical sciences and engineering with additional credits providing the opportunity for specialization in: one of the programs; complementary studies courses; and elective subjects. A minimum of 23.50 credits must be obtained. At least 3.00 credits must be complementary studies, which consist of courses in the social sciences, arts, management, engineering economics and communication. They complement the technical content of the curriculum.

All credits are selected according to the schedule of studies for the program. Restrictions apply to the number of non–core credits which may be at the 1000 level. Further information on approved courses may be obtained from the B.Sc.(Eng.) Program Guide available from the director or program counsellor of the School of Engineering.

Programs

The choice of program is made at the time of application. Change of program requires the approval of the director.

The available programs are:

Biological Engineering – the application of engineering to the control and management of biological processes, environments, and human factors in engineering design.

Engineering Systems and Computing – the application of engineering to the design, operation and management of data sensing, transmission and, processing systems, and of control systems.

Environmental Engineering – the application of engineering to protect and restore the environment, through the prevention and treatment of gaseous, liquid and solid wastes.

Water Resources Engineering – the application of engineering to the control and management of water and soil resources to meet human needs while sustaining the natural environment.

The schedule of studies for each program is provided below but guidance in the selection of appropriate courses is available from the program counsellor of the School of Engineering.

Additional Course Requirements

Students lacking OAC courses are advised to consult the Recommendations and Notes in Section IV—Admission Information–B.Sc.(Eng.).

Continuation of Study

Students are advised to consult the regulations for continuation of study within the program which are outlined in detail in Section VIII, Undergraduate Degree Regulation & Procedures. Students will be ineligible to continue in the B.Sc. (Eng.) program and will not be readmitted to the degree program if the same course is failed three times.

Normally, students in the B.Sc. (Eng.) program will be permitted only one supplemental privilege during their studies. It will usually be granted for 3000 or 4000 level courses only.

Conditions for Graduation

To qualify for the degree the student must complete the courses required for a B.Sc. (Eng.) program, obtaining a minimum of 23.50 credits and must meet the appropriate continuation of study requirement.

Co–operative Education

Students studying for the B.SC. (ENG.) degree may participate in a Co–operative Education program following the completion of the first 4 semesters of study. The Co–operative Education program consists of a minimum of 4 semesters of experience in industry with employers who participate in the program. Reports and assignments are graded by a faculty supervisor with assistance from the employer. Evaluations of Co–op semesters are recorded on the student's academic record. The Co–operative Education program provides an excellent opportunity for students to obtain work experience in industry directly related to their field of study. Interested students should consult their program counsellor.

Students wishing to participate in the Co–operative Education program should indicate their intention to do so by applying for admission to the Co–op program on entrance. Following the completion of semester 2, in–course applicants will be considered for admission to the Co–op program.

Successful applicants will:

1. have a minimum cumulative average of 70% in semesters 1 and 2
2. have successfully completed all of the credits required in the schedule of studies for semesters 1 and 2
3. be employable in Canada (i.e. be a Canadian citizen or a permanent resident in Canada)
4. have obtained the approval of their Co–op advisor in the school to participate in the program. The Co–op advisor's approval will signify that the schedule of work semesters in the Co–op program as planned by the student is compatible with the schedule of studies in the program in which the student is enrolled.
5. completion of COOP*1100 is a requirement for entry into the first work term.

Please refer to Co–operative Education Program for Admission requirements into the Co–op Program.

Co–op Work Schedule

	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5
Fall	1	3	5	6	work
Winter	2	4	work	7	8
Spring		work	work	work	

All candidates must complete a minimum of 4 of the preceding 5 work terms.

X—Degree Programs, Bachelor of Science in Engineering [B.Sc.(Eng.)]

Biological Engineering Program Regular and Co–op (BIOE/BIOE:C)

School of Engineering, College of Physical and Engineering Science.
Students interested in problems requiring the application of knowledge from both the biological sciences and engineering will find a challenge as a Biological Engineer. This field of engineering relates to the control of technological processes with the aim of enhancing human, animal and plant life. The program encompasses the technologies of biotechnology, waste management, food engineering, and ergonomics. For example, a Biological Engineer concentrating on biotechnology might design and manage bioreactors to improve their productivity. A career in Biomedical Engineering, which requires graduate work beyond the Bachelor's degree, involves designing instruments and diagnostic techniques to be used in the practice of medicine, developing prosthetic devices, and applying engineering techniques to the study of physiological systems.

Major (Honours Program)

Semester 1 – 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
HIST*1250	[0.50]	Science and Society Since 1500
MATH*1200	[0.50]	Calculus I

Semester 2 – Regular or Co–op

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

Semester 3 – Regular or Co–op

COOP*1100	[0.00]	Introduction to Co–operative Education
ENGG*2100	[0.75]	Engineering and Design II
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
MICR*1020	[0.50]	Fundamentals of Applied Microbiology

Semester 4 – Regular or Co–op

CHEM*2580	[0.50]	Introductory Biochemistry
ENGG*2230	[0.50]	Fluid Mechanics
ENGG*2450	[0.50]	Network Theory
ENGG*2660	[0.50]	Biological Engineering Systems I
MATH*2130	[0.50]	Numerical Methods
STAT*2120	[0.50]	Probability and Statistics for Engineers

Semester 5 – 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

0.50 restricted elective

Semester 6 Regular / Semester 7 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

1.00 restricted electives

Semester 7 Regular / Semester 6 Co–op

ENGG*4390	[0.75]	Bio–instrumentation Design

2.75 restricted electives

Semester 8 (Winter) – Regular or Co–op

ENGG*4110	[1.00]	Biological Engineering Design IV
ENGG*4280	[0.75]	Digital Process Control Design

1.00 restricted elective

Restricted Electives (see Program Guide for more information)

- 2.00 credits in Complementary Studies Electives
- 0.75 credit in required Design Elective
- 1.00 credits in Biological Engineering Electives
- 1.00 credits in Life Science Electives
- 0.50 credits in Free electives

X—Degree Programs, Bachelor of Science in Engineering [B.Sc.(Eng.)]

Environmental Engineering Program Regular and Co–op (ENVE/ENVE:C)

School of Engineering, College of Physical and Engineering Science.

In recent years there has been concern about the degradation of the environment. The School of Engineering has responded to this concern by developing an Environmental Engineering program. Graduates will possess design and skills to minimize and prevent the impact of human activities on water, soil and air systems. Graduates will also creatively integrate humanistic and social perspectives in their solutions.

Major (Honours Program)

Semester 1 – 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
HIST*1250	[0.50]	Science and Society Since 1500
MATH*1200	[0.50]	Calculus I

Semester 2 – Regular or Co–op

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

Semester 3 – Regular or Co–op

COOP*1100	[0.00]	Introduction to Co–operative Education
ENGG*2100	[0.75]	Engineering and Design II
ENGG*2120	[0.50]	Material Science
ENGG*2400	[0.50]	Engineering Systems Analysis
MATH*2270	[0.50]	Applied Differential Equations

0.50 restricted elective

One of:

BIOL*1030	[0.50]	Biology I
MICR*1020	[0.50]	Fundamentals of Applied Microbiology

Semester 4 – Regular or Co–op

ENGG*2230	[0.50]	Fluid Mechanics
ENGG*2450	[0.50]	Network Theory
ENGG*2560	[0.50]	Environmental Engineering Systems
MATH*2130	[0.50]	Numerical Methods
STAT*2120	[0.50]	Probability and Statistics for Engineers

One of:

BIOL*1040	[0.50]	Biology II

0.50 restricted elective

Note: Students select 0.50 restricted elective in Semester 4 if MICR*1020 was selected in Semester 3.

Semester 5 – 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

0.50 restricted elective

Semester 6 Regular / Semester 7 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

1.00 restricted elective

Semester 7 Regular / Semester 6 Co–op

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

0.50 restricted elective

Semester 8 – Regular or Co–op

ENGG*4130	[1.00]	Environmental Engineering Design IV
ENGG*4260	[0.75]	Water and Wastewater Treatment Design
GEOL*3060	[0.50]	Groundwater

0.50 restricted elective

Restricted Electives

Environmental engineering students must complete the following restricted electives (see Program Guide for more information). Yu can take these courses where Restricted Electives are indicated in the schedule of courses. A maximum of three 1000 level electives is allowed. Restricted electives must include:

2.00 credits in Complementary Studies electives

0.50 credit in Free Elective

0.50 credit in Science/Engineering electives

One of:

0.50 credit in Science electives (if MICR*1020 is selected in Semester 3)

BIOL*1040 (if BIOL*1030 is selected in Semester 3)

Note: The following courses should not be used as Free Electives:

CHEM*2820	[0.50]	Thermodynamics and Kinetics
CHEM*2880	[0.50]	Physical Chemistry
GEOG*3620	[0.50]	Desert Environments
GEOL*3190	[0.50]	Environmental Water Chemistry
PHYS*1600	[0.50]	Contemporary Astronomy
SOIL*3070	[0.50]	Environmental Soil Physics
SOIL*3080	[0.50]	Soil and Water Conservation
TOX*3360	[0.50]	Environmental Chemistry and Toxicology

Minor (Honours Program)

The minor can be satisfied by taking the following additional courses:

BIOL*2060	[0.50]	Ecology
CHEM*2580	[0.50]	Introductory Biochemistry
CHEM*3360	[0.50]	Environmental Chemistry and Toxicology
ENGG*3180	[0.50]	Air Quality
ENGG*3590	[0.50]	Water Quality
ENGG*4260	[0.75]	Water and Wastewater Treatment Design
GEOG*1300	[0.50]	Introduction to the Biophysical Environment
MICR*1020	[0.50]	Fundamentals of Applied Microbiology
MICR*4180	[0.50]	Microbial Processes in Environmental Management

One of:

ENGG*2560	[0.50]	Environmental Engineering Systems
ENGG*2660	[0.50]	Biological Engineering Systems I

Students must select an environmental application project for the design course in the student's major program.

X—Degree Programs, Bachelor of Science in Engineering [B.Sc.(Eng.)]

Engineering Systems and Computing Program Regular and Co–op (ESC/ESC:C)

School of Engineering, College of Physical and Engineering Science.

In the last quarter century, the computer has grown so rapidly in importance that engineering, science, business and industry could not function without it. With this growth, a need has evolved for specialists who can incorporate computers and information into complex industrial processes. The Engineering Systems and Computing program has been conceived to satisfy this need. Graduates from this program will have, in addition to the basic engineering skills, the ability to identify application areas where computer technology represents the optimum solution, specify appropriate software for process control, data reduction and/or expert system implementation and integrate the computer into the overall system application.

Major (Honours Program)

Semester 1 – Regular or Co–op

CHEM*1040	[0.50]	General Chemistry I
CIS*1650	[0.50]	Programming I
ENGG*1100	[0.75]	Engineering and Design I
HIST*1250	[0.50]	Science and Society Since 1500
MATH*1200	[0.50]	Calculus I

Semester 2 – Regular or Co–op

CIS*1900	[0.50]	Discrete Structures in Computer Science
CIS*2650	[0.50]	Programming II
ENGG*1210	[0.50]	Engineering Mechanics I
ENGG*1500	[0.50]	Engineering Analysis
MATH*1210	[0.50]	Calculus II
PHYS*1130	[0.50]	Introductory Physics with Applications II

Semester 3 – Regular or Co–op

CIS*2420	[0.50]	Data Structures
COOP*1100	[0.00]	Introduction to Co–operative Education
ENGG*2100	[0.75]	Engineering and Design II
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

Semester 4 – Regular or Co–op

CIS*3110	[0.50]	Operating Systems
ENGG*2230	[0.50]	Fluid Mechanics
ENGG*2450	[0.50]	Network Theory
ENGG*3410	[0.50]	Systems and Control Theory
MATH*2130	[0.50]	Numerical Methods
STAT*2120	[0.50]	Probability and Statistics for Engineers

Semester 5 – Regular or Co–op

ENGG*3240	[0.50]	Engineering Economics
ENGG*3260	[0.50]	Thermodynamics
ENGG*3390	[0.50]	Signal Processing
ENGG*3450	[0.50]	Electrical Devices
ENGG*3640	[0.50]	Microcomputer Interfacing

0.50 restricted elective

Semester 6 Regular / Semester 7 Co–op

CIS*3490	[0.50]	The Analysis and Design of Computer Algorithms
ENGG*3100	[0.75]	Engineering and Design III
ENGG*3430	[0.50]	Heat and Mass Transfer

1.00 or 1.25 restricted elective

Semester 7 Regular / Semester 6 Co–op

ENGG*4420	[0.75]	Real–time Systems Design
ENGG*4450	[0.50]	Large–Scale Software Architecture Engineering

1.50 or 1.75 restricted electives

Semester 8 – Regular or Co–op

ENGG*4120	[1.00]	Engineering Systems and Computing Design IV
ENGG*4280	[0.75]	Digital Process Control Design

1.00 elective

Restricted Electives (see Program Guide for more information)

2.00 credits in Complementary Studies
1.50 credits in ES&C Engineering Electives
0.75 credits in Engineering Design Electives

X—Degree Programs, Bachelor of Science in Engineering [B.Sc.(Eng.)]

Water Resources Engineering Program Regular and Co–op (WRE/WRE:C)

School of Engineering, College of Physical and Engineering Science.

Water resources engineering focuses on the use and management of land and water resources in rural and urban watersheds. The hydrologic and hydraulic behaviour of watershed flow systems is combined with engineering science and. Water management includes flood prevention, warning and control; drainage; design of natural channels; irrigation; and erosion prevention and control. The supply of water for municipal, industrial and agricultural purposes is considered in the context of resource conservation. Identification of potential point and diffused sources of pollutants is used to develop efficient, environmentally sustainable and economical methods to preserve high–quality water to sustain human life and water–dependent ecosystems.

Major (Honours Program)

Semester 1 – 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
HIST*1250	[0.50]	Science and Society Since 1500
MATH*1200	[0.50]	Calculus I

Semester 2 – Regular or Co–op

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

Semester 3 – Regular or Co–op

COOP*1100	[0.00]	Introduction to Co–operative Education
ENGG*2100	[0.75]	Engineering and Design II
ENGG*2120	[0.50]	Material Science
ENGG*2400	[0.50]	Engineering Systems Analysis
GEOG*2000	[0.50]	Geomorphology
MATH*2270	[0.50]	Applied Differential Equations
MICR*1020	[0.50]	Fundamentals of Applied Microbiology

Semester 4 – Regular or Co–op

ENGG*2230	[0.50]	Fluid Mechanics
ENGG*2450	[0.50]	Network Theory
ENGG*2550	[0.50]	Water Management
ENGG*2560	[0.50]	Environmental Engineering Systems
MATH*2130	[0.50]	Numerical Methods
STAT*2120	[0.50]	Probability and Statistics for Engineers

Semester 5 – 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

0.50 restricted elective

Semester 6 Regular / Semester 7 Co–op

ENGG*3100	[0.75]	Engineering and Design III
ENGG*3430	[0.50]	Heat and Mass Transfer
GEOL*3060	[0.50]	Groundwater

1.50 restricted electives

Semester 7 Regular / Semester 6 Co–op

ENGG*4250	[0.75]	Watershed Systems Design
ENGG*4360	[0.75]	Soil–Water Conservation Systems Design
ENGG*4370	[0.75]	Urban Water Systems Design
GEOG*3480	[0.50]	Geographic Information Systems

0.50 restricted elective

Semester 8 (Winter) Regular or Co–op

ENGG*4150	[1.00]	Water Resources Engineering Design IV

1.50 restricted electives

Restricted Electives (see Program Guide for more information)

- 1.00 credits in Engineering electives
- 0.50 credits in Environmental electives
- 2.00 credits in Complementary Studies
- 0.50 credits in Water Resources elective

X—Degree Programs, Bachelor of Science in Engineering [B.Sc.(Eng.)]

Food Engineering (FENG)

School of Engineering, College of Physical and Engineering Science.

Minor (Honours Program)

The minor can be satisfied by taking the following additional courses:

AGEC*2220	[0.50]	Financial Accounting
CHEM*2580	[0.50]	Introductory Biochemistry
ENGG*2660	[0.50]	Biological Engineering Systems I
ENGG*3830	[0.50]	Bio–Process Engineering
FOOD*2150	[0.50]	Introduction to Nutritional and Food Sciences
MICR*1020	[0.50]	Fundamentals of Applied Microbiology

0.75 Biological Engineering Design Course*

One of:

ENGG*4260	[0.75]	Water and Wastewater Treatment Design
ENGG*4300	[0.75]	Food Processing Engineering Design

Two of:

COST*3010	[0.50]	Quality Management
FOOD*4070	[0.50]	Food Packaging
FOOD*4110	[0.50]	Meat and Poultry Processing

One of:

FOOD*3160	[0.75]	Food Processing I
FOOD*4520	[0.50]	Cereal Technology

One of:

FOOD*3230	[0.75]	Food Microbiology
FOOD*4350	[0.50]	Processing Plant Technology

**students must select a food application project for the design course in the student's major program*

NOTE: Courses taken for the minors are credited to appropriate elective areas.