

# ENGINEERING SYSTEMS AND COMPUTING (ESC)

## School of Engineering, College of Engineering and Physical Sciences

Engineering Systems and Computing - the application of systems thinking and interdisciplinary engineering to solve complex, multi-faceted, meaningful problems by analyzing, modelling, and designing computer-based systems, including biomedical applications, robotics, artificial intelligence, and human-centred computing. These systems typically include a heterogeneous set of hardware and software components integrated into a unified framework to achieve an optimal, computer-controlled system solution. Systems thinking enables the understanding and modelling of industrial and societal processes as interconnected elements working together to serve a larger purpose. Graduates from Engineering Systems and Computing are systems thinkers who analyze, model, and design engineering systems with the aid of modern computational tools. Students in this major have the opportunity to take electives in areas such as control systems, biomedical, robotics, mechatronics, embedded systems, internet of things, software-hardware systems, and human-centred computing.

## Major Requirements (Honours)

**This is a major within the degree:** Bachelor of Engineering ([calendar.uoguelph.ca/undergraduate-calendar/degree-programs/bachelor-engineering-beng/](http://calendar.uoguelph.ca/undergraduate-calendar/degree-programs/bachelor-engineering-beng/)).

Code	Title	Credits
<b>Semester 1</b>		
CHEM*1040	General Chemistry I	0.50
ENGG*1100	Engineering and Design I	0.75
ENGG*1410	Introductory Programming for Engineers	0.50
MATH*1200	Calculus I	0.50
PHYS*1130	Physics with Applications	0.50
<b>Semester 2</b>		
ENGG*1210	Engineering Mechanics I	0.50
ENGG*1420	Object-Oriented Programming for Engineers	0.50
ENGG*1500	Engineering Analysis	0.50
MATH*1210	Calculus II	0.50
PHYS*1010	Introductory Electricity and Magnetism	0.50
<b>Semester 3</b>		
CIS*2520	Data Structures	0.50
ENGG*2230	Fluid Mechanics	0.50
ENGG*2400	Engineering Systems Analysis	0.50
ENGG*2410	Digital Systems Design Using Descriptive Languages	0.50
MATH*2270	Applied Differential Equations	0.50
0.50 restricted electives		0.50
<b>Semester 4</b>		
ENGG*2100	Engineering and Design II	0.75
ENGG*2120	Material Science	0.50
ENGG*2450	Electric Circuits	0.50
MATH*2130	Numerical Methods	0.50
STAT*2120	Probability and Statistics for Engineers	0.50
0.50 restricted electives		0.50

## Semester 5

ENGG*3260	Thermodynamics	0.50
ENGG*3390	Signal Processing	0.50
ENGG*3450	Electronic Devices	0.50
ENGG*3640	Microcomputer Interfacing	0.50
ENGG*4450	Large-Scale Software Architecture Engineering	0.50
0.50 restricted electives		0.50

## Semester 6

ENGG*3100	Engineering and Design III	0.75
ENGG*3130	Modelling Complex Systems	0.50
ENGG*3410	Systems and Control Theory	0.50
ENGG*3430	Heat and Mass Transfer	0.50
HIST*1250	Science and Technology in a Global Context	0.50
0.50 restricted electives		0.50

## Semester 7

ENGG*3240	Engineering Economics	0.50
ENGG*4000	Proposal for Engineering Design IV	0.00
ENGG*4420	Real-time Systems Design	0.75
1.50 or 1.75 restricted electives		1.50-1.75

## Semester 8

ENGG*4120	Engineering Systems and Computing Design IV	1.00
ENGG*4490	Sampled Data Control Design	0.75
1.00 or 1.25 electives		1.00-1.25

## Restricted Electives

(see Program Guide for more information)

The Engineering Program requires Engineering Systems and Computing students to complete the following combination of elective credits to complete their program:

- 2.75 credits from the ESC Engineering Systems and Computing electives
- 2.00 credits from Complementary Studies electives

Consult the Program Guide for further information on the prerequisite requirements specific to each elective. Students can take a maximum of 1.50 credits at the 1000 level from the above list of electives.

## Co-op Requirements (Honours)

**This is a major within the degree:** Bachelor of Engineering ([calendar.uoguelph.ca/undergraduate-calendar/degree-programs/bachelor-engineering-beng/](http://calendar.uoguelph.ca/undergraduate-calendar/degree-programs/bachelor-engineering-beng/)).

The Co-op program in Engineering Systems and Computing is a five year program, including five work terms. Students must follow the academic work schedule as outlined below (also found on the Co-operative Education website: <https://www.recruitguelph.ca/cecs/>).

## Academic and Co-op Work Term Schedule

Year	Fall	Winter	Summer
1	Academic Semester 1	Academic Semester 2	Off

2	Academic Semester 3 COOP*1100	Academic Semester 4	COOP*1000 Work Term I
3	Academic Semester 5	COOP*2000 Work Term II	COOP*3000 Work Term III
4	Academic Semester 6	Academic Semester 7	COOP*4000 Work Term IV
5	COOP*5000 Work Term V	Academic Semester 8	N/A

Please refer to the Co-operative Education program policy with respect to work term performance grading, work term report grading and program completion requirements.

For additional program information students should consult with their Co-op Co-ordinator and Co-op Faculty Advisor, listed on the Co-operative Education web site.

## Credit Summary

(26.00 Total Credits)

Code	Title	Credits
	Required Core Courses	18.75
	ESC Engineering Systems and Computing Electives	2.75
	Complementary Studies Electives	2.00
	Co-op Work Terms	2.50
	<b>Total Credits</b>	<b>26</b>

## Recommended Program Sequence

Code	Title	Credits
<b>Semester 1 - Fall</b>		
CHEM*1040	General Chemistry I	0.50
ENGG*1100	Engineering and Design I	0.75
ENGG*1410	Introductory Programming for Engineers	0.50
MATH*1200	Calculus I	0.50
PHYS*1130	Physics with Applications	0.50
<b>Semester 2 - Winter</b>		
ENGG*1210	Engineering Mechanics I	0.50
ENGG*1420	Object-Oriented Programming for Engineers	0.50
ENGG*1500	Engineering Analysis	0.50
MATH*1210	Calculus II	0.50
PHYS*1010	Introductory Electricity and Magnetism	0.50
<b>Summer Semester</b>		
No academic semester or work term		
<b>Semester 3 - Fall</b>		
CIS*2520	Data Structures	0.50
COOP*1100	Introduction to Co-operative Education	0.00
ENGG*2230	Fluid Mechanics	0.50
ENGG*2400	Engineering Systems Analysis	0.50
ENGG*2410	Digital Systems Design Using Descriptive Languages	0.50
MATH*2270	Applied Differential Equations	0.50
0.50 restricted electives		0.50
<b>Semester 4 - Winter</b>		
ENGG*2100	Engineering and Design II	0.75
ENGG*2120	Material Science	0.50

ENGG*2450	Electric Circuits	0.50
MATH*2130	Numerical Methods	0.50
STAT*2120	Probability and Statistics for Engineers	0.50
0.50 restricted electives		0.50
<b>Summer Semester</b>		
COOP*1000	Co-op Work Term I	0.50
<b>Semester 5 - Fall</b>		
ENGG*3260	Thermodynamics	0.50
ENGG*3390	Signal Processing	0.50
ENGG*3450	Electronic Devices	0.50
ENGG*3640	Microcomputer Interfacing	0.50
ENGG*4450	Large-Scale Software Architecture Engineering	0.50
0.50 restricted electives		0.50
<b>Winter Semester</b>		
COOP*2000	Co-op Work Term II	0.50
<b>Summer Semester</b>		
COOP*3000	Co-op Work Term III	0.50
<b>Semester 6 - Fall</b>		
ENGG*3240	Engineering Economics	0.50
ENGG*4420	Real-time Systems Design	0.75
1.50 or 1.75 restricted electives		1.50-1.75
<b>Semester 7 - Winter</b>		
ENGG*3100	Engineering and Design III	0.75
ENGG*3130	Modelling Complex Systems	0.50
ENGG*3410	Systems and Control Theory	0.50
ENGG*3430	Heat and Mass Transfer	0.50
HIST*1250	Science and Technology in a Global Context	0.50
0.50 restricted electives		0.50
<b>Summer Semester</b>		
COOP*4000	Co-op Work Term IV	0.50
<b>Fall Semester</b>		
COOP*5000	Co-op Work Term V	0.50
ENGG*4000	Proposal for Engineering Design IV	0.00
<b>Semester 8 - Winter</b>		
ENGG*4120	Engineering Systems and Computing Design IV	1.00
ENGG*4490	Sampled Data Control Design	0.75
1.00 or 1.25 electives		1.00-1.25

## Restricted Electives

(see Program Guide for more information)

The Engineering Program requires Engineering Systems and Computing students to complete the following combination of elective credits to complete their program:

- 2.75 credits from the ESC Engineering Systems and Computing electives
- 2.00 credits from Complementary Studies electives

Consult the Program Guide for further information on the prerequisite requirements specific to each elective. Students can take a maximum of 1.50 credits at the 1000 level from the above list of electives.