

# BIOMEDICAL ENGINEERING (BME)

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

Biomedical Engineering is a field of engineering that deals with health and medicine. (e.g.: electronic and mechanical devices used on biological materials, animals and humans, medical implants and instruments, ergonomics, bioinstrumentation, imaging and pharmacology). Graduates in Biomedical engineering are able to apply mathematical, scientific and engineering principles to a wide variety of fields and find employment across the private and public sectors of the health care industry. The program provides students with a common base of knowledge essential to engineering, and then allows them to select from a menu of electives to attain a degree of specialization in one of three areas, or to choose electives which broaden their general knowledge base. Elective concentrations are available in the areas of biomechanics; biosignal processing; and pharmaceuticals. The program is built around the concept of interdisciplinary application of engineering principles to health related problems.

## Major Requirements (Honours)

This is a major within the degree: Bachelor of Engineering.

Code	Title	Credits
<b>Semester 1</b>		
CHEM*1040	General Chemistry I	0.50
ENGG*1100	Engineering and Design I	0.75
ENGG*1500	Engineering Analysis	0.50
MATH*1200	Calculus I	0.50
PHYS*1130	Physics with Applications	0.50
<b>Semester 2</b>		
CHEM*1050	General Chemistry II	0.50
CIS*1500	Introduction to Programming	0.50
ENGG*1210	Engineering Mechanics I	0.50
MATH*1210	Calculus II	0.50
PHYS*1010	Introductory Electricity and Magnetism	0.50
<b>Semester 3</b>		
ENGG*2160	Engineering Mechanics II	0.50
ENGG*2230	Fluid Mechanics	0.50
ENGG*2400	Engineering Systems Analysis	0.50
MATH*2270	Applied Differential Equations	0.50
STAT*2120	Probability and Statistics for Engineers	0.50
0.50 restricted electives <sup>1</sup>		0.50
<b>Semester 4</b>		
BIOL*1080	Biological Concepts of Health	0.50
BIOM*2000	Concepts in Human Physiology	0.50
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
<b>Semester 5</b>		
BIOM*3010	Biomedical Comparative Anatomy	0.50
ENGG*3260	Thermodynamics	0.50

ENGG*3390	Signal Processing	0.50
ENGG*3450	Electronic Devices	0.50
HIST*1250	Science and Technology in a Global Context	0.50
0.50 restricted electives		0.50
<b>Semester 6</b>		
ENGG*3100	Engineering and Design III	0.75
ENGG*3170	Biomaterials	0.50
ENGG*3410	Systems and Control Theory	0.50
ENGG*3430	Heat and Mass Transfer	0.50
PATH*3610	Principles of Disease	0.50
0.50 restricted electives		0.50
<b>Semester 7</b>		
ENGG*3240	Engineering Economics	0.50
ENGG*4000	Proposal for Engineering Design IV	0.00
ENGG*4390	Bio-instrumentation Design	0.75
2.00 restricted electives		2.00
<b>Semester 8</b>		
ENGG*4180	Biomedical Engineering Design IV	1.00
1.75 restricted electives		1.75

<sup>1</sup> Students planning to pursue the pharmaceutical series of electives are advised to select BIOL\*1080 Biological Concepts of Health in place of the 0.50 restricted elective in Semester 3 and select ENGG\*2660 as an elective in Semester 4 for prerequisite sequencing.

## Restricted Electives

(see Program Guide for more information)

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

- 2.50 credits from the BME-1 Biomedical Engineering electives
- 0.75 credits from the BME-2 Biomedical Engineering design electives
- 2.00 credits from Complementary Studies electives

Consult the Program Guide for further information on the prerequisite requirements specific to each elective.

## Co-op Requirements (Honours)

This is a major within the degree: Bachelor of Engineering.

The Co-op program in Biomedical Engineering 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

<b>4</b>	Academic Semester 6	Academic Semester 7	COOP*4000 Work Term IV
<b>5</b>	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

(26.25 Total Credits)

Code	Title	Credits
Required Core Courses		18.50
BME-1 Biomedical Engineering Electives		2.50
BME-2 Biomedical Engineering Design Electives		0.75
Complementary Studies Electives		2.00
Co-op Work Terms		2.50
<b>Total Credits</b>		<b>26.25</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*1500	Engineering Analysis	0.50
MATH*1200	Calculus I	0.50
PHYS*1130	Physics with Applications	0.50
<b>Semester 2 - Winter</b>		
CHEM*1050	General Chemistry II	0.50
CIS*1500	Introduction to Programming	0.50
ENGG*1210	Engineering Mechanics I	0.50
MATH*1210	Calculus II	0.50
PHYS*1010	Introductory Electricity and Magnetism	0.50
<b>Semester 3 - Fall</b>		
COOP*1100	Introduction to Co-operative Education	0.00
ENGG*2100	Engineering and Design II	0.75
ENGG*2120	Material Science	0.50
ENGG*2160	Engineering Mechanics II	0.50
ENGG*2400	Engineering Systems Analysis	0.50
MATH*2270	Applied Differential Equations	0.50
0.50 restricted electives <sup>1</sup>		0.50
<b>Semester 4 - Winter</b>		
BIOL*1080	Biological Concepts of Health	0.50
BIOM*2000	Concepts in Human Physiology	0.50
ENGG*2230	Fluid Mechanics	0.50
ENGG*2450	Electric Circuits	0.50
MATH*2130	Numerical Methods	0.50
STAT*2120	Probability and Statistics for Engineers	0.50
<b>Summer Semester</b>		
COOP*1000	Co-op Work Term I	0.50

<b>Semester 5 - Fall</b>		
BIOM*3010	Biomedical Comparative Anatomy	0.50
ENGG*3260	Thermodynamics	0.50
ENGG*3390	Signal Processing	0.50
ENGG*3450	Electronic Devices	0.50
HIST*1250	Science and Technology in a Global Context	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*4390	Bio-instrumentation Design	0.75
2.00 restricted electives		2.00
<b>Semester 7 - Winter</b>		
ENGG*3100	Engineering and Design III	0.75
ENGG*3170	Biomaterials	0.50
ENGG*3410	Systems and Control Theory	0.50
ENGG*3430	Heat and Mass Transfer	0.50
PATH*3610	Principles of Disease	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*4180	Biomedical Engineering Design IV	1.00
1.75 restricted electives		1.75

<sup>1</sup> Students planning to pursue the pharmaceutical series of electives are advised to select BIOL\*1080 Biological Concepts of Health in place of the 0.50 restricted elective in Semester 3 and select ENGG\*2660 as an elective in Semester 4 for prerequisite sequencing.

## Restricted Electives

(see Program Guide for more information)

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

- 2.50 credits from the BME-1 Biomedical Engineering electives
- 0.75 credits from the BME-2 Biomedical Engineering design electives
- 2.00 credits from Complementary Studies electives

Consult the Program Guide for further information on the prerequisite requirements specific to each elective.