

# BIOMEDICAL ENGINEERING, PH.D.

## Degree Requirements

A minimum of 12 credit hours plus a thesis are required in the BME program. The minimum must include 6 credit hours from the following core courses:

Course	Title	Hours
BME 7012	Foundation of Physiology	2
ANAT 7014	Functional Human Anatomy	2
BME 7022	Biomedical Instrumentation	2
BME 7024	Basics of Electromagnetic	2
BME 7026	Basics of Biological Signal Analysis	2
BME 7028	Basics of Biomechanics	2

plus the 0 credit hour Ethics course (BME 7040) and the 0 credit hour BME Seminar course (BME 7000).

Students from Engineering backgrounds normally have to take anatomy and physiology. Students from Science backgrounds should not enroll in anatomy and physiology.

The remaining 6 credit hours of the minimum course requirement must be taken at the 7000-level relevant to the student's thesis from any departments of the faculties of Engineering, Science and Health Sciences or Department of Physiology and Pathophysiology based on the suggestions of the student's Advisory Committee. The student's program of study must be recommended by the student's advisory committee and approved by the Chair of the Curriculum Committee or delegate. Students who lack the necessary background knowledge may be required, by their Advisory Committee, to take additional courses up to the maximum allowed by FGS regulations.

**Expected Time to Graduate:** 4 years

## Progression Chart

### 12-Credit Hour Program

- Students with a Master of Science program in Engineering, Science, and/or Medical
- 6 credit hours of Core courses
- At least 6 credit hours at the 7000 level or higher

Course	Title	Hours
<b>Year 1</b>		
GRAD 7300	Research Integrity Tutorial	0
GRAD 7500	Academic Integrity Tutorial	0
BME 7000	Biomedical Engineering Seminar <sup>1,2</sup>	0
BME 7040	Biomedical Ethics	0
BME Thesis Proposal Presentation		0
<b>Hours</b>		<b>0</b>
<b>Years 1-2</b>		
Select 6 credit hours in BME Core Courses of the following: <sup>3</sup>		6
BME 7012	Foundation of Physiology	
ANAT 7014	Functional Human Anatomy	
BME 7022	Biomedical Instrumentation	

BME 7024	Basics of Electromagnetic	
BME 7026	Basics of Biological Signal Analysis	
BME 7028	Basics of Biomechanics	
Select at least 6 credit hours in Research courses at the 7000 level or higher <sup>4</sup>		6
<b>Hours</b>		<b>12</b>
<b>Year 2</b>		
GRAD 8010	Doctoral Candidacy Examination	0
<b>Hours</b>		<b>0</b>
<b>Years 2-4</b>		
GRAD 8000	Doctoral Thesis <sup>5</sup>	0
<b>Hours</b>		<b>0</b>
<b>Total Hours</b>		<b>12</b>

<sup>1</sup> BME Graduate Students are required to enroll and attend the Biomedical Engineering Seminar each term until graduation.

<sup>2</sup> BME M.Sc. student must present at least once at the BME Seminar before graduation.

<sup>3</sup> Where a student has already completed similar courses to the BME core courses, the student may, with the recommendation of their Academic Advisor and with the approval of the Chair of the Curriculum Committee or delegate, be exempted from taking the equivalent core courses and allowed to fulfill the six (6) ch of core courses with six (6) ch of other courses taken at the 7000-8000 level from any department in the Faculties of Engineering, Science, and Health Sciences or from the Physiology and Pathophysiology Program.

<sup>4</sup> As determined by the Academic Advisor [http://umanitoba.ca/biomedical\\_engineering/current\\_student/phd.html#PhD\\_ProgramType](http://umanitoba.ca/biomedical_engineering/current_student/phd.html#PhD_ProgramType)

<sup>5</sup> Notes regarding thesis completion: [http://umanitoba.ca/biomedical\\_engineering/current\\_students/phd.html](http://umanitoba.ca/biomedical_engineering/current_students/phd.html)

### Notes:

BME M.Sc. Program Requirements: [https://umanitoba.ca/biomedical\\_engineering/current\\_students/phd.html#CourseReq](https://umanitoba.ca/biomedical_engineering/current_students/phd.html#CourseReq) (Engineering Student must take Life Science Core Courses and Life Science Students must take Engineering Core Courses)

(Engineering Student must take Life Science Core Courses and Life Science Students must take Engineering Core Courses)

### 18-Credit Hour Program (Minimum)

- Admitted directly from a Doctor of Medicine Degree (MD)
- 6 credit hours of Core courses
- At least 12 credit hours at the 7000 or higher
- Additional undergraduate courses might be required pending review by the Advisory Committee

Course	Title	Hours
<b>Year 1</b>		
GRAD 7300	Research Integrity Tutorial	0
GRAD 7500	Academic Integrity Tutorial	0
BME 7000	Biomedical Engineering Seminar <sup>1,2</sup>	0
BME 7040	Biomedical Ethics	0
BME Thesis Proposal Presentation		0
<b>Hours</b>		<b>0</b>
<b>Years 1-2</b>		
Select 6 credit hours in BME Core Courses of the following: <sup>3</sup>		6

BME 7012	Foundation of Physiology	
ANAT 7014	Functional Human Anatomy	
BME 7022	Biomedical Instrumentation	
BME 7024	Basics of Electromagnetic	
BME 7026	Basics of Biological Signal Analysis	
BME 7028	Basics of Biomechanics	
Select at least 12 credit hours in Research courses at the 7000 level or higher <sup>4</sup>		12
<b>Hours</b>		<b>18</b>
<b>Year 2</b>		
GRAD 8010	Doctoral Candidacy Examination	0
<b>Hours</b>		<b>0</b>
<b>Years 2-4</b>		
GRAD 8000	Doctoral Thesis <sup>5</sup>	0
<b>Hours</b>		<b>0</b>
<b>Total Hours</b>		<b>18</b>

<sup>1</sup> BME Graduate Students are required to enroll and attend the Biomedical Engineering Seminar each term until graduation.

<sup>2</sup> BME M.Sc. student must present at least once at the BME Seminar before graduation.

<sup>3</sup> Where a student has already completed similar courses to the BME core courses, the student may, with the recommendation of their Academic Advisor and with the approval of the Chair of the Curriculum Committee or delegate, be exempted from taking the equivalent core courses and allowed to fulfill the six (6) ch of core courses with six (6) ch of other courses taken at the 7000-8000 level from any department in the Faculties of Engineering, Science, and Health Sciences or from the Physiology and Pathophysiology Program.

<sup>4</sup> As determined by the Academic Advisor [http://umanitoba.ca/biomedical\\_engineering/current\\_student/phd.html#PhD\\_ProgramType](http://umanitoba.ca/biomedical_engineering/current_student/phd.html#PhD_ProgramType)

<sup>5</sup> Notes regarding thesis completion: [http://umanitoba.ca/biomedical\\_engineering/current\\_students/phd.html](http://umanitoba.ca/biomedical_engineering/current_students/phd.html)

#### Notes:

BME M.Sc. Program Requirements: [https://umanitoba.ca/biomedical\\_engineering/current\\_students/phd.html#CourseReq](https://umanitoba.ca/biomedical_engineering/current_students/phd.html#CourseReq)  
(Engineering Student must take Life Science Core Courses and Life Science Students must take Engineering Core Courses)

(Engineering Student must take Life Science Core Courses and Life Science Students must take Engineering Core Courses)

#### 24-Credit Hour Program

- BME MSc Students who do not hold an MSc and who have been recommended for transfer to the BME Ph.D. program
- 6 credit hours of Core courses
- 12 credit hours of Research courses, recommended and approved by the Academic Advisor (6 credit hours may be at the 4000 level or higher)

Course	Title	Hours
<b>Year 1</b>		
GRAD 7300	Research Integrity Tutorial	0
GRAD 7500	Academic Integrity Tutorial	0
BME 7000	Biomedical Engineering Seminar <sup>1,2</sup>	0
BME 7040	Biomedical Ethics	0

#### BME Thesis Proposal Presentation

<b>Hours</b>		<b>0</b>
<b>Years 1-2</b>		
Select 6 credit hours of BME Core Courses from the following: <sup>3</sup>		6
BME 7012	Foundation of Physiology	
ANAT 7014	Functional Human Anatomy	
BME 7022	Biomedical Instrumentation	
BME 7024	Basics of Electromagnetic	
BME 7026	Basics of Biological Signal Analysis	
BME 7028	Basics of Biomechanics	
Select 12 credit hours of Research Courses <sup>4,5</sup>		12
<b>Hours</b>		<b>18</b>
<b>Year 2</b>		
GRAD 8010	Doctoral Candidacy Examination	0
<b>Hours</b>		<b>0</b>
<b>Years 2-4</b>		
GRAD 8000	Doctoral Thesis <sup>6</sup>	0
<b>Hours</b>		<b>0</b>
<b>Total Hours</b>		<b>18</b>

<sup>1</sup> BME Graduate Students are required to enroll and attend the Biomedical Engineering Seminar each term until graduation.

<sup>2</sup> BME M.Sc. student must present at least once at the BME Seminar before graduation.

<sup>3</sup> Where a student has already completed similar courses to the BME core courses, the student may, with the recommendation of their Academic Advisor and with the approval of the Chair of the Curriculum Committee or delegate, be exempted from taking the equivalent core courses and allowed to fulfill the six (6) ch of core courses with six (6) ch of other courses taken at the 7000-8000 level from any department in the Faculties of Engineering, Science, and Health Sciences or from the Physiology and Pathophysiology Program.

<sup>4</sup> As determined by the Academic Advisor [http://umanitoba.ca/biomedical\\_engineering/current\\_student/phd.html#PhD\\_ProgramType](http://umanitoba.ca/biomedical_engineering/current_student/phd.html#PhD_ProgramType)

<sup>5</sup> Recommended and approved by the Academic Advisor (6 credit hours may be at the 4000 level or higher).

<sup>6</sup> Notes regarding thesis completion: [http://umanitoba.ca/biomedical\\_engineering/current\\_students/phd.html](http://umanitoba.ca/biomedical_engineering/current_students/phd.html)

#### Notes:

BME M.Sc. Program Requirements: [https://umanitoba.ca/biomedical\\_engineering/current\\_students/phd.html#CourseReq](https://umanitoba.ca/biomedical_engineering/current_students/phd.html#CourseReq)  
(Engineering Student must take Life Science Core Courses and Life Science Students must take Engineering Core Courses)

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