

BIOMEDICAL ENGINEERING, PH.D.

Biomedical Engineering

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Academic Staff: Please refer to the Biomedical Engineering website (<https://umanitoba.ca/engineering/faculty-staff/biomedical-engineering/>) for Faculty information.

Biomedical Engineering Program Information

Biomedical Engineering (BME) at the University of Manitoba is a graduate program toward Master of Science, Doctor of Philosophy, and/or MD-PhD degrees. It is an interdisciplinary program between the three faculties of Engineering, Medicine and Science, and the associated hospitals and medical industries.

Admission Information

Admission to the Faculty of Graduate Studies

Application and Admission Procedures are found in the Academic Guide (<https://catalog.umanitoba.ca/graduate-studies/academic-guide/application-admission-registration-policies/>).

Admission requirements for doctoral students are found in the Doctor of Philosophy General Regulations (<https://catalog.umanitoba.ca/graduate-studies/academic-guide/doctor-philosophy-general-regulations/>) section of the Guide.

Biomedical Engineering Ph.D. Admission Requirements

Students admitted to this program will normally have a M.Sc. degree from a Faculty of Engineering, Health Sciences, or Science or with a Doctor of Medicine (MD) Degree from a recognized university.

In addition, the following **pre-requisite** courses are required prior to an offer of admissions:

Course	Title	Hours
MATH 1210	Techniques of Classical and Linear Algebra	3
MATH 1510	Applied Calculus 1	3
PHYS 1050	Physics 1: Mechanics	3

Application Information

Students should complete and submit their online application with supporting documentation by the date indicated on the Biomedical Engineering Ph.D. program of study (<https://umanitoba.ca/explore/programs-of-study/biomedical-engineering-phd/>) page.

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
Year 1		
GRAD 7300	Research Integrity Tutorial	0
GRAD 7500	Academic Integrity Tutorial	0
BME 7000	Biomedical Engineering Seminar ^{1,2}	0
BME 7040	Biomedical Ethics	0
BME Thesis Proposal Presentation		0
		Hours
		0
Years 1-2		
Select 6 credit hours in BME Core Courses of the following: ³		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 ⁴		6
		Hours
		12
Year 2		
GRAD 8010	Doctoral Candidacy Examination	0
		Hours
		0

Years 2-4		
GRAD 8000	Doctoral Thesis ⁵	0
Hours		0
Total Hours		12

- ¹ BME Graduate Students are required to enroll and attend the Biomedical Engineering Seminar each term until graduation.
- ² BME M.Sc. student must present at least once at the BME Seminar before graduation.
- ³ 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.
- ⁴ As determined by the Academic Advisor http://umanitoba.ca/biomedical_engineering/current_student/phd.html#PhD_ProgramType
- ⁵ Notes regarding thesis completion: 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 (Engineering Student must take Life Science Core Courses and Life Science Students must take Engineering Core Courses)

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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
Year 1		
GRAD 7300	Research Integrity Tutorial	0
GRAD 7500	Academic Integrity Tutorial	0
BME 7000	Biomedical Engineering Seminar ^{1,2}	0
BME 7040	Biomedical Ethics	0
BME Thesis Proposal Presentation		0
Hours		0

Years 1-2

Select 6 credit hours in BME Core Courses of the following: ³		
BME 7012	Foundation of Physiology	6
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 ⁴		12
Hours		18

Year 2

GRAD 8010	Doctoral Candidacy Examination	0
Hours		0

Years 2-4

GRAD 8000	Doctoral Thesis ⁵	0
Hours		0
Total Hours		18

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- ³ 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.
- ⁴ As determined by the Academic Advisor http://umanitoba.ca/biomedical_engineering/current_student/phd.html#PhD_ProgramType
- ⁵ Notes regarding thesis completion: http://umanitoba.ca/biomedical_engineering/current_students/phd.html

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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
Year 1		
GRAD 7300	Research Integrity Tutorial	0
GRAD 7500	Academic Integrity Tutorial	0
BME 7000	Biomedical Engineering Seminar ^{1,2}	0
BME 7040	Biomedical Ethics	0
BME Thesis Proposal Presentation		0
Hours		0

Years 1-2

Select 6 credit hours of BME Core Courses from the following: ³		6
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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 ^{4,5}		12
Hours		18
Year 2		
GRAD 8010	Doctoral Candidacy Examination	0
Hours		0
Years 2-4		
GRAD 8000	Doctoral Thesis ⁶	0
Hours		0
Total Hours		18

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

² BME M.Sc. student must present at least once at the BME Seminar before graduation.

³ 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.

⁴ As determined by the Academic Advisor http://umanitoba.ca/biomedical_engineering/current_student/phd.html#PhD_ProgramType

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

⁶ Notes regarding thesis completion: http://umanitoba.ca/biomedical_engineering/current_students/phd.html

Notes:

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Registration Information

Students should familiarize themselves with the Faculty of Graduate Studies 'GRAD' courses applicable to their program (<https://catalog.umanitoba.ca/graduate-studies/registration-information/>). If you have questions about which GRAD course(s) to register in, please consult your home department/unit.

Courses are subject to cancellation if there is insufficient enrolment. Courses with insufficient enrolment may be cancelled the first week of classes. Not all courses will be offered each year – contact the department for courses that will not be offered. All returning and newly

admitted students must see an academic advisor or the department head prior to attempting to register.

Regulations

Students must meet the requirements as outlined in both Supplementary Regulation and BFAR documents as approved by Senate.

Supplementary Regulations

Individual units may require specific requirements above and beyond those of the Faculty of Graduate Studies, and students should consult unit supplementary regulations (<https://umanitoba.ca/graduate-studies/supplementary-regulations/>) for these specific regulations.

Bona Fide Academic Requirements (BFAR)

Bona Fide Academic Requirements (BFAR) (<https://catalog.umanitoba.ca/graduate-studies/academic-guide/academic-performance-general/#BFAR>) represent the core academic requirements a graduate student must acquire in order to gain, and demonstrate acquisition of, essential knowledge and skills.

All students must successfully complete:

- GRAD 7300 prior to applying to any ethics boards which are appropriate to the student's research or within the student's first year, whichever comes first; and
- GRAD 7500 within the first term of registration;

unless these courses have been completed previously, as per Mandatory Academic Integrity Course (<https://catalog.umanitoba.ca/graduate-studies/academic-guide/academic-performance-general/#GRAD7500>) and Mandatory Research Integrity Online Course (<https://catalog.umanitoba.ca/graduate-studies/academic-guide/academic-performance-general/#GRAD7300>).

Students must also meet additional BFAR requirements (<https://umanitoba.ca/graduate-studies/student-experience/core-academic-requirements/#additional-requirements-by-program>) that may be specified for their program.

General Regulations

All students must:

- maintain a minimum degree grade point average of 3.0 with no grade below C+,
- meet the minimum and not exceed the maximum course requirements, and
- meet the minimum and not exceed the maximum time requirements (in terms of time in program and lapse or expiration of credit of courses).