

Doctor of Philosophy in Biomedical Engineering

The M.S. and Ph.D. programs in Biomedical Engineering are offered by UND and North Dakota State University (NDSU). The proposed programs would be offered jointly by UND's College of Engineering and Mines, School of Medicine and Health Sciences, and NDSU's College of Engineering.

Every M.S. or Ph.D. student will be associated with at least one of the following Biomedical Research Groups (BRGs):

- Biomechanics
- Biomaterials
- Bio-instrumentation
- Multi-scale, bio-system simulation and modeling
- Bio-Signals
- Other emerging areas as identified

Two separate graduate degree programs are offered:

- Master of Science (M.S.) in Biomedical Engineering
- Doctor of Philosophy (Ph.D.) in Biomedical Engineering

The student's graduate committee for both the M.S. and Ph.D. must consist of at least one faculty member from NDSU.

Program Requirements

This program prepares students who have a strong interest in gaining in-depth knowledge in biomedical engineering at the graduate level. Specific requirements over and above the general UND Academic Catalog requirements are listed below.

Minimum Admission Requirements

1. Bachelor of Science degree from an ABET-accredited engineering program; or
2. Students holding a B.S. degree in other disciplines may be admitted to Qualified Status with an obligation to acquire the necessary background undergraduate engineering knowledge. The exact requirements will be determined on a case-by-case basis; and/or
3. Graduate Record Examination General Test for applicants from non-ABET accredited programs; and
4. Minimum GPA is 3.0 (4.0 scale) is required. Conditional admittance may be obtained for GPAs less than 3.0.

Degree Requirements (total 90 credits)

Required:

Anatomy-Physiology (3-6 credits) from the following:

EE 590	Advanced Electrical Engineering Problems (Physiology and Anatomy for Biomedical Engineers)	6
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or

Zoo 660	(NDSU - Animal Physiology)	3
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Seminar (3-6 credits, 1 credit per semester) taken from the following:

ENGR 562	Seminar in Engineering	1
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EE 570	Seminar	1
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ENGR 790	(NDSU - Seminar)	1
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Classes related to BRG		12-15
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Dissertation		6-30
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Electives:

Graduate Preparation, e.g., Grant Writing		3-6
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Internship (industrial, clinical or research lab)		3-6
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Electives:		1-36
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Elective courses (approved by advisor)		up to 36
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Note: A maximum of 30 credits can be transferred from a M.S. program.

If a student is assigned to more than one BRG, he/she can take courses in those BRGs to satisfy required classes.

The following courses may be considered for the above BRGs:

Bioinstrumentation BRG

EE 539	Electromagnetic Compatibility	3
EE 456	Digital Image Processing	3
EE 521	Digital Signal Processing	3
EE 545	Introduction to Biomedical Engineering	3
EE 550	Biomedical Instrumentation	3
ECE 683	(NDSU - Instrumentation for Engineers)	3
ECE 685	(NDSU - Biomedical Engineering)	3
ECE 796	(NDSU - Biomedical Photonics)	3

Biomaterials BRG

ME 490	Special Laboratory Problems	1-3
EE 545	Introduction to Biomedical Engineering	3
CHE 593A	Special Topics (Biochemical Engineering)	1-3
CHEM 665	(NDSU - Principles of Physical Chemistry and Biophysics)	3
ECE 685	(NDSU - Biomedical Engineering)	3
ECE 701	(NDSU - Quantitative Drug Design)	2
CE 725	(NDSU - Introduction to Biomaterials, Materials in Biomedical Engineering)	3
MN 785	(NDSU - Biocompatibility Testing)	3
MN 786	(NDSU - Tissue Engineering)	3

Biomechanics BRG

ME 439	Introduction to Robotics	3
ME 490	Special Laboratory Problems	1-3
ME 529	Advanced Finite Element Methods	3
EE 545	Introduction to Biomedical Engineering	3
ECE 485	(NDSU - Biomedical Engineering)	3
ME 668	(NDSU - Introduction to Biomechanics)	3
ME 680	(NDSU - Biofluid Mechanics)	3
ME 743	(NDSU - Biomechanics of Impact)	3
ME 755	(NDSU - Fluid Mechanics for Bio/Nanotechnologies)	3

Biosignals BRG

EE 456	Digital Image Processing	3
EE 508	Intelligent Decision Systems	3
EE 521	Digital Signal Processing	3
EE 539	Electromagnetic Compatibility	3
EE 545	Introduction to Biomedical Engineering	3
EE 590	Advanced Electrical Engineering Problems (Engineering Computation)	3
EE 590	Advanced Electrical Engineering Problems (Biomedical Signal Processing)	3
ECE 685	(Biomedical Engineering)	3

Multi-Scale System Simulation and Modeling BRG

EE 545	Introduction to Biomedical Engineering	3
ECE 685	(NDSU - Biomedical Engineering)	3
ECE 687	(NDSU - Cardiovascular Engineering I)	3

ECE 688	(NDSU - Advanced Cardiovascular Engineering II)	3
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List of Elective Courses:

In addition to the following list, BRG courses can be considered as elective courses.

PPT 500	Principles of Physiology and Pharmacology	6
PPT 503	Advanced Pharmacology or Physiology	3
PPT 505	Research Techniques	1-3
BIMD 510	Basic Biomedical Statistics	2
BIMD 516	Responsible Conduct of Research	2
NURS 510	Adv Physiology/Pathophysiology I	3
NURS 511	Adv Physiology/Pathophys II	3
NURS 573	Research Funding	3
BIOC 673	(NDSU - Methods of Biochemical Research)	3
BIOC 716	(NDSU - Biochemistry of Proteins and Enzymes)	4
CPM 771	(NDSU - Methods of Polymer Characterization)	3
CHEM 685	(NDSU - Industrial Biotechnology)	2
PSCI 611	(NDSU - Pharmacodynamics and Applied Therapeutics)	3
NURS 702	(NDSU - Ethics/Policy)	
NURS 706	(NDSU - Healthcare Delivery Systems, Financing, & Informatics)	
NURS 714	(NDSU - Advanced Pathophysiology I)	
NURS 716	(NDSU - Advanced Pathophysiology II)	
PHARM 685	(NDSU - Economic Outcomes Assessment)	

Other classes as deemed appropriate by student's advisory committee