Students accepted to the Master of Science in Bioengineering program have the option to carry out research or complete a course-only program of studies:

- Thesis option resulting in the preparation and defense of an MS thesis (BIOE 7990), 8 semester hours of research.

Students who select to complete an MS thesis as part of their degree must form a thesis committee comprised of at least three members. The thesis committee must include the thesis advisor, and at least two members must be tenured or tenure-track faculty (either BioE or BioE-affiliated faculty). One committee member must be both a tenured or tenure-track faculty in BioE or a BioE-affiliated faculty and a faculty in the College of Engineering. The student shall present the thesis to this committee and to the BioE faculty at large in the form of a seminar before final approval of the thesis by the committee.

- MS project option (Master’s Project (BIOE 7890), 4 semester hours of research)
- Course-only option

Students are required to complete a total of 33 semester hours of courses with a minimum cumulative grade-point average (GPA) of 3.000 to graduate with an MS in bioengineering. All MS students are required to take two core courses (Medical Physiology (BIOE 5100), and Principles of Bioengineering (BIOE 6000)). Each student must select a concentration and complete two required courses specific to that concentration. In addition, each student needs to complete 12 semester hours of technical electives if they are completing the thesis option, 16 semester hours for the project option, or 20 semester hours for the course-only option. Courses are selected from an approved list of technical electives for their concentration. Enrollment in Seminar (BIOE 7390) is required each term.

Students have four concentrations from which to choose:

- Concentration 1: Bioimaging and Signal Processing
- Concentration 2: Cell and Tissue Engineering
- Concentration 3: Biomechanics
- Concentration 4: Biomedical Devices

Concentrations

A concentration is required. Each concentration has two required courses and a list of technical electives from which the student should select three to five courses, depending on whether he or she selects the thesis option, project option, or course-only option.

**CONCENTRATION IN BIOIMAGING AND SIGNAL PROCESSING**

This concentration is appropriate for students interested in biomedical imaging and processing of a wide array of signals from biological systems and biomedical instruments. Two courses (Linear Systems Analysis (EECE 7200), and Applied Probability and Stochastic Processes (EECE 7204)) are required of all students choosing this option. Extensive additional options are available as approved technical electives.

**CONCENTRATION IN CELL AND TISSUE ENGINEERING**

The cell and tissue engineering concentration is appropriate for students interested in molecular, cell, and tissue engineering. Two courses (Molecular Bioengineering (BIOE 5410), and (BIOE 5420)) are required of all cell and tissue engineering students. There is an extensive list of approved technical electives to choose from to complete the degree.

**CONCENTRATION IN BIOENGINEERING**

Students who join the biomechanics concentration will cover multiscale mechanics, including whole-body movement, mechanical properties of biomaterials, and fluid mechanics of physiological fluids. The two courses required of all biomechanics concentration students are Multiscale Biomechanics (BIOE 5650) and Musculoskeletal Biomechanics (ME 5665).

**CONCENTRATION IN BIOMEDICAL DEVICES**

The biomedical devices concentration is appropriate for students interested in the design and implementation of biological devices and implants. Two core courses, Design of Biomedical Instrumentation (BIOE 5810), and Design, Manufacture, and Evaluation of Medical Devices (BIOE 5250), are required for all students in this concentration.

**Graduate Certificate Options**

Students enrolled in a graduate degree program in the College of Engineering have the opportunity to pursue an engineering graduate certificate in addition to or in combination with the MS degree. For more information please refer to Graduate Certificate Programs (http://catalog.northeastern.edu/graduate/engineering/graduate-certificate-programs).

**GORDON INSTITUTE OF ENGINEERING LEADERSHIP**

**Master’s Degree in Bioengineering with Graduate Certificate in Engineering Leadership**

Students may complete a Master of Science in Bioengineering in addition to earning a Graduate Certificate in Engineering Leadership. Students must apply and be admitted to the Gordon Engineering Leadership Program in order to pursue this option. The program requires fulfillment of the 16-semester-hour-curriculum required to earn the Graduate Certificate in Engineering Leadership, which includes an industry-based challenge project with multiple mentors. The integrated 33-semester-hour degree and certificate will require 17 hours of advisor-approved bioengineering technical courses.

Engineering Leadership (http://catalog.northeastern.edu/graduate/engineering/leadership/engineering-leadership-graduate-certificate/#text)

**Program Requirements**

Complete all courses and requirements listed below unless otherwise indicated.

**Note:** This major requires a concentration: biomechanics, biomedical devices, bioimaging and signal processing, or cell and tissue engineering. Consult your college administrator.

**General Requirements**

**Seminar**

| BIOE 7390 | Seminar | 0 |

**Required Core**

A grade of C or higher is required in each course:

| BIOE 5100 | Medical Physiology | 4 |
| BIOE 6000 | Principles of Bioengineering | 1 |

**Concentrations**

Complete one of the following four concentrations:
Bioengineering, MSBioE

- Bioimaging and Signal Processing (p. 2)
- Cell and Tissue Engineering (p. 2)
- Biomechanics (p. 2)
- Biomedical Devices (p. 2)

**Bioimaging and Signal Processing**

**Required Course Work**

A grade of C or higher is required.

- **EECE 7200** Linear Systems Analysis 4
- **EECE 7204** Applied Probability and Stochastic Processes 4

**Course Work Option**

Complete 20 semester hours from the course list. 20

**Project Option**

- **BIOE 7890** Master’s Project 4

**Electives**

Complete 16 semester hours from the course list. 16

**Thesis Option**

Complete the following (repeatable) course twice: 8

- **BIOE 7990** Thesis

**Electives**

Complete 12 semester hours from the course list. 12

**Course List**

- **BIOE 5320** Advanced Biomedical Measurements and Instrumentation
- **BIOE 5235** Biomedical Imaging
- **BIOE 7100** Special Topics in Biomedical Imaging and Signal Processing
- **BIOE 5581** Biological Imaging
- **EECE 5639** Computer Vision
- **EECE 5648** Biomedical Optics
- **EECE 7203** Complex Variable Theory and Differential Equations
- **EECE 7204** Applied Probability and Stochastic Processes
- **EECE 7314** Auditory Signal Processing
- **PHSC 6226** Imaging in Medicine and Drug Discovery

**Cell and Tissue Engineering**

**Required Course Work**

A grade of C or higher is required.

- **BIOE 5410** Molecular Bioengineering 4
- **BIOE 5420** Cellular Engineering 4

**Course Work Option**

Complete 20 semester hours from the course list. 20

**Project Option**

- **BIOE 7890** Master’s Project 4

**Electives**

Complete 16 semester hours from the course list. 16

**Thesis Option**

Complete the following (repeatable) course twice: 8

- **BIOE 7990** Thesis

**Electives**

Complete 12 semester hours from the course list. 12

**Course List**

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**Biomechanics**

**Required Course Work**

A grade of C or higher is required.

- **ME 5665** Musculoskeletal Biomechanics 4
- **BIOE 5650** Multiscale Biomechanics 4

**Course Work Option**

Complete 20 semester hours from the course list. 20

**Project Option**

- **BIOE 7890** Master’s Project 4

**Electives**

Complete 16 semester hours from the course list. 16

**Thesis Option**

Complete the following (repeatable) course twice: 8

- **BIOE 7990** Thesis

**Electives**

Complete 12 semester hours from the course list. 12

**Course List**

- **BIOE 5630** Physiological Fluid Mechanics
- **BIOE 5651** Biomaterials
- **BIOE 7001** Biomaterials
- **BIOE 7300** Special Topics in Biomechanics
- **BIOE 5553** Biology of Muscle: Molecules to Movements
- **BIOE 5601** Multidisciplinary Approaches in Motor Control
- **BIOE 7384** Topics in Integrative Biology
- **EECE 7200** Linear Systems Analysis
- **EECE 7203** Complex Variable Theory and Differential Equations
- **EECE 7367** Robotics and Automation Systems
- **ME 5650** Advanced Mechanics of Materials
- **ME 5655** Dynamics and Mechanical Vibration
- **ME 5657** Finite Element Method
- **ME 5659** Control Systems Engineering
- **ME 5667** Solid Mechanics of Cells and Tissues
- **ME 7210** Elasticity and Plasticity
- **ME 7238** Advanced Finite Element Method
- **ME 7240** Composite Materials
- **ME 7245** Fracture Mechanics and Failure Analysis
- **ME 7255** Continuum Mechanics

**Biomedical Devices**

**Required Course Work**

- **BIOE 5430** Principles and Applications of Tissue Engineering
- **BIOE 5820** Biomaterials
- **BIOE 5543** Stem Cells and Regeneration
- **BIOE 6301** Molecular Cell Biology
- **CHEM 5500** Introduction to Regulatory Science
- **ME 5667** Solid Mechanics of Cells and Tissues
- **NNMD 5370** Nanomedicine Research Techniques
- **NNMD 5470** Nano- and Biomedical Commercialization: From Concept to Market
A grade of C or higher is required.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>BIOE 5810</td>
<td>Design of Biomedical Instrumentation</td>
<td>4</td>
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<tr>
<td>BIOE 5250</td>
<td>Design, Manufacture, and Evaluation of Medical Devices</td>
<td>4</td>
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</table>

**Course Work Option**

Complete 20 semester hours from the course list. **20**

**Project Option**

BIOE 7890    Master’s Project                      4

**Electives**

Complete 16 semester hours from the course list. **16**

**Thesis Option**

Complete the following (repeatable) course twice: **8**

BIOE 7990    Thesis

**Electives**

Complete 12 semester hours from the course list. **12**

**Course List**

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</tbody>
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**Program Credit/GPA Requirements**

33 total semester hours required
Minimum 3.000 GPA required