**BIOENGINEERING (MS)**

**Master of Science in Bioengineering**

Unit: Speed School of Engineering (https://engineering.louisville.edu)
Department: Bioengineering (https://engineering.louisville.edu/bioengineering)
Academic Plan Code: BE_ _MS

**Program Information**

**General Information**

The Master of Science in Bioengineering program offers advanced-level training that provides students with in-depth knowledge of bioengineering in areas such as bio computational modeling, bioimaging, bioinstrumentation, biomaterials, biomechanics, biomedical devices, bioMEMS, bionanotechnology, biosensors, biosignal processing, biosystems control, molecular bioengineering, and tissue engineering. Student educational experiences are enhanced by research opportunities in laboratories conducting basic and translational research on oncology, cardiovascular disease, nanotherapeutics, orthopedics, drug delivery, injury, tissue regeneration and image-based diagnostics.

The Master of Science (MS) degree program is intended for persons having an accredited baccalaureate degree in bioengineering, but is available to those with other backgrounds. Applicants with other backgrounds should plan on taking some undergraduate background coursework. Students interested in the MS degree program should consult the Director of Graduate Studies in the Department of Bioengineering. The University of Louisville is accredited by the Commission on Colleges of the Southern Association of Colleges and Schools to award master’s degrees.

The Master of Science in Bioengineering program objectives are to:

1. Train highly motivated graduate students who demonstrate advanced level bioengineering expertise and practical engineering experience necessary to function as bioengineering professionals. *(Advanced Knowledge and Life-long Learning)*
2. Develop students with the bioengineering expertise and practical experience necessary for employment in industry, academia or government, or further professional/graduate studies. *(Career Opportunities)*
3. Develop students with an understanding of the broad, social, ethical and professional issues of contemporary engineering practice. *(Awareness and Responsibility)*

**Academic Performance**

The J.B. Speed School of Engineering has established the following performance policies:

1. The minimum grade point average requirement for good standing and satisfaction of degree requirements is 3.00 for all academic work completed while in graduate studies.
2. Any student who does not satisfy the published performance criteria shall be placed in probationary status. Please review the Academic Standing Section (https://catalog.louisville.edu/graduate/general-policies-procedures-requirements) within this catalog in regard to Academic Probation.
3. Students receiving graduate assistantships (teaching, research or service) shall be provided adequate training and shall be required to understand and adhere to University policies related to these areas.

The performance of teaching, research and service duties by such students shall be periodically evaluated. Students with teaching assistantships shall be evaluated annually.

4. Students who fail to meet performance goals or who do not meet other requirements as outlined in the admission letter, program requirements or the university catalog may be subject to academic dismissal from their programs.

All graduate students are expected to make steady and satisfactory progress toward the completion of degrees. Students who are not enrolled for a period of more than 12 months will be considered to have withdrawn from the program. Students who seek to return after such a period of time must contact the graduate program director.

**Degree Requirements**

The following degree requirements are mandatory of all Master of Science candidates:

1. The program of study must be completed with a 3.00 GPA or better for all graduate courses used to satisfy degree requirements. Additionally, the program of study must be completed with a 3.00 GPA or better for all academic work attempted in graduate studies.
2. Masters students must take at least 24 credit hours of coursework at the University of Louisville to satisfy the residency requirement for the master’s degree. A maximum of six (6) credit hours of graduate credit may be transferred from accredited institutions.
4. Student has six years after their admission to the MS program to complete their degree.

The requirements for the Master of Science degree are discussed in more detail in the Degree Requirements (https://catalog.louisville.edu/graduate/general-policies-procedures-requirements) section of this catalog.

**Admission Standards**

The admission standards for the master of science program in bioengineering are as follows:

1. All admission applications for the program shall include:
   a. A completed application for admission (http://louisville.edu/graduate/apply) for the Graduate School,
   b. An application fee,
   c. Results from the Graduate Record Examination (GRE)
   d. At least two letters of recommendation, and
   e. Official transcript(s) for all previous post-secondary coursework.
      All transcripts not in English must be certified as authentic and translated verbatim into English.
2. The minimum requirement for admission is the baccalaureate degree or its equivalent from an accredited institution.
3. The successful applicant will typically have an undergraduate grade point average of 3.00 or above (on a 4.00 scale).
4. The successful applicant will typically have a GRE score at or above the 60th percentile on verbal and quantitative sections.
5. Admission in good standing shall be made only if all admission credentials have been received, evaluated and approved and all academic requirements met including a demonstration of adequate
A student may be admitted provisionally if academic requirements are met but application materials are incomplete (usually missing letters of recommendation or official transcripts and/or official score reports). Students have one semester to furnish any credentials missing at the time of admission and may not enroll for a second consecutive term in provisional status.

6. International students whose primary language is not English must show English language proficiency by either TOEFL/IELTS score or demonstration of a degree aware from an acceptable English language institution. The successful applicant will typically have a TOEFL score of 80 or higher or overall IELTS score of 6.5 or higher.

### Degree Requirements

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<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
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<tbody>
<tr>
<td>BE 621</td>
<td>Bioinstrumentation</td>
<td>4</td>
</tr>
<tr>
<td>BE 654</td>
<td>Advanced Physiology for Engineers</td>
<td>3</td>
</tr>
<tr>
<td>BE 601</td>
<td>Bioengineering Doctoral Seminar (two)</td>
<td>2</td>
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<tr>
<td>CHE 686</td>
<td>Chemical Engineering Analysis</td>
<td>3</td>
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<tr>
<td>BE 695</td>
<td>Bioengineering Research Design &amp; Methods</td>
<td>3</td>
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#### Technical Electives

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<tr>
<th>Code</th>
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<tbody>
<tr>
<td>BE 698</td>
<td>Master of Science Thesis in Bioengineering</td>
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<tr>
<td>or BE 691</td>
<td>Bioengineering Non-thesis Design/Research Project</td>
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#### Minimum Total Hours

30

The master of science degree must be completed with a 3.00 GPA or better for all graduate courses used to satisfy degree requirements and all academic work attempted in graduate studies.

1. Thesis option students complete nine (9) credit hours of concentration coursework; non-thesis option students complete 12 credit hours of concentration coursework.

2. Thesis option students complete six (6) credit hours of BE 698 Master of Science Thesis in Bioengineering; non-thesis option students complete three (3) credit hours of BE 691 Bioengineering Non-thesis Design/Research Project.

### Technical Electives

**Bioelectrical & Biomedical Devices**

- **BE 524** LabVIEW for Bioengineers
- **BE 581** Advanced Computer Aided Design and Manufacturing for Bioengineers

- **BE 611** Cardiovascular Dynamics
- **BE 650** Advanced Biomaterials
- **BE 680** Bio-Micro
- **BE 683** Artificial Organs
- **ECE 543** Fundamentals of Microfabrication and MEMS

**Bioimaging & Biocomputational Modeling**

- **BE 540** Machine Learning in Medicine
- **BE 542** Medical Image Computing
- **BE 600** Advanced Topics in Bioengineering
- **BE 640** Computational Methods for Medical Image Analysis

- **CECS 622** Simulation and Modeling of Discrete Systems
- **CECS 660** Introduction to Bioinformatics
- **CECS 627** Digital Image Processing
- **CECS/ECE 641** Medical Imaging Systems
- **ECE 643** Introduction to Biomedical Computing

**Biomechanics & Rehabilitation**

- **BE 581** Advanced Computer Aided Design and Manufacturing for Bioengineers
- **BE 611** Cardiovascular Dynamics
- **BE 630** Biomechanical Computer Modeling and Simulation of Human Movement
- **BE 639** Injury Biomechanics
- **BE 658** Rehabilitation Engineering and Assistive Technology

**Molecular & Tissue Engineering**

- **BE 552** Introduction to Tissue Engineering
- **BE 553** Nanoscale Bioengineering: Application and Methodology of Nanobiomaterials in Bioengineering
- **BE 605** Tissue & Molecular Biology Techniques Laboratory
- **BE 650** Advanced Biomaterials
- **BIOC 680** Biomolecular Interactions
- **BIOC 668** Molecular Biology and Genetics
- **BIOC 611** Advanced Techniques in Biochemistry and Molecular Biology