

# M.S. IN BIOENGINEERING

## OVERVIEW

Bioengineers work at the interface of engineering and living systems. At UToledo, our master's program provides key training in focused areas. For example, learn how to design, build, and test medical devices; build computational models to predict joint loading and surgical intervention outcomes; or develop sensors to better detect physiological signals – all to improve the human condition. The possibilities are endless. Please see our department website for details regarding faculty research areas. Our master's-level graduates often transition to successful careers in a range of bio-industries or continue on to pursue Ph.D. or M.D. degrees.

## ADMISSIONS REQUIREMENTS

The MS graduate programs in the Department of Bioengineering are open to all qualified individuals with a Bachelor of Science (B.S.) or Master of Science (M.S.) in Engineering. Students with a B.S., B.A., or M.S./M.A. degree in a related field are also eligible provided they meet the minimum prerequisite coursework requirement of two (2) years of calculus through differential equations, and one (1) year of engineering physics.

To be competitive for admission, all applicants should have a grade point average of at least 3.0/4.0 for all previous undergraduate work and 3.3/4.0 for all previous graduate work. In some cases, additional prerequisite courses related to the program of study may be required (see Provisional Admission). Course credits for meeting undergraduate prerequisites are not applied toward the graduate degree.

The GRE exam is required for all students who do not hold a B.S. degree from a US institution, and international students are expected to complete the TOEFL exam. The minimum scores for the GRE are set by the Department of Bioengineering; the minimum scores for the TOEFL exam are set by the College of Graduate Studies. The minimum scores considered are:

- GRE - 300 combined for the verbal and quantitative sections
- TOEFL - 550 (PBT); 80 (IBT)

Application requirements:

- **Degree:** Applicants must hold a four-year bachelor's degree from an accredited college or university
- **GPA:** Applicants must have at least a 3.0/4.0 grade point average from previous undergraduate coursework or a 3.3/4.0 for previous graduate coursework
- **Application:** UToledo application required
- **GRE:** Required for applicants whose B.S. degree is from a non-US institution.
- **Transcripts:** Required
- **Statement of Purpose:** Required

- **Letters of Recommendation:** 3

- **Proof of English language proficiency:** Required for students from non-English speaking countries. See University graduate admissions for minimum test score requirements and exceptions.

Application priority deadlines for admissions and funding decisions:

- **Fall:** January 15
- **Spring:** October 1
- **Summer:** Contact Department

## PROGRAM REQUIREMENTS

The Master of Science program in bioengineering has three options:

- thesis,
- project and
- coursework.

The thesis option requires the completion of a minimum of 21 credit hours of approved graduate course work, 9 hours of thesis research and the successful defense of a research-based thesis. The project option requires the completion of a minimum of 24 credit hours of approved graduate course work and 6 hours of project research. The coursework option requires the completion of at least 30 hours of approved graduate course work only. All course work must be approved by the student's adviser (or the graduate director). The M.S. curriculum is designed to provide a general, flexible framework for students in selecting course work that is relevant to their specific area of research. Each student must meet the following minimum general course work requirements:

Code	Title	Hours
<b>Required coursework</b>		<b>6</b>
BIOE 5200 or BIOE 6100	Physiology And Anatomy For Bioengineers Computational Physiology	3
MIME 6000	Advanced Engineering Mathematics I	3
BIOE 5930	Bioengineering Seminar (Register and attend every semester)	0
<b>Elective coursework</b>		<b>15-24</b>
Elective coursework cr hr requirements depend on capstone option. Up to 6 cr hr may be entrepreneurship elective coursework. All remaining coursework must be engineering, mathematics, or science-based. Elective coursework options include, but are not limited to, the courses listed below.		
BIOE 5260	Medical Imaging Systems I	3
BIOE 5650	Bioseparations	3
BIOE 5670	Ultrasound Principles And Medical Applications	3
BIOE 5730	Computational Bioengineering	3
BIOE 5740	Tissue Engineering	3
BIOE 5750	Experimental Methods In Orthopedic Biomechanics	3
BIOE 5780	Advanced Biomechanics	3
BIOE 5830	Additive Manufacturing	3

BIOE 6310	Cell and Tissue Engineering Laboratory	3
BIOE 6520	Orthopaedic Biomechanics	3
BIOE 6730	Biological Transport Phenomena	3
MIME 5280	Cad - Finite Element Methods	3
MIME 5460	Advanced MATLAB for Engineers	3
MIME 6650	Advanced Material Science and Engineering	3
CHEE 6120	Biofuels	3
CHEM 5170	Chemistry Instrumentation Techniques	2
BIOL 6300	Advanced Microscopy and Imaging	3
EFSB 6590	New Venture Creation	3
EFSB 6690	Strategic Management of Innovation	3

**Capstone option***Thesis option:*

BIOE 6960	Bioengineering Research And Thesis - Master's	9
Elective coursework		15

*Project option:*

BIOE 6920	Bioengineering Project	6
Elective coursework		18

*Coursework option*

Elective coursework		24
---------------------	--	----

- PLO 1) Solve problems using advanced mathematics, engineering and biomedical sciences
- PLO 2) Communicate research rationale and results in scientific presentations and refereed publications
- PLO 3) Independently design and conduct laboratory research
- PLO 4) Lead research or project teams with direction from supervisors