

# Master of Engineering Engineering with a Concentration in Biomedical Engineering (ME)

## Biomedical Engineering Program

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The Biomedical Engineering graduate degree programs are available to full-time and part-time students seeking to improve their research and professional skills in biomedical engineering. The programs strive to provide the highest quality engineering education at the graduate level, to engage in scholarly research at the forefront of biomedical engineering, and to serve the biomedical engineering profession. While the biomedical engineering program is administered by the Department of Electrical & Computer Engineering, the program is highly interdisciplinary, and students are admitted from broad areas of engineering, science, and healthcare. Cutting-edge research opportunities and instruction are offered in:

- Bioelectrics and Pulsed Power
- Cellular & Molecular Bioengineering
- Cardiovascular Engineering
- Musculoskeletal Biomechanics
- Plasma Medicine
- Systems Biology & Computational Bioengineering

**Facilities:** The Biomachina Laboratory; the Biomechanics Laboratory; Biomedical Devices and Biomanufacturing Lab; the Cellular Mechanobiology Laboratory; the Machine Intelligence & HR Communications Lab; the Gene Therapy and Regenerative Medicine Laboratory; the Medical Simulations Laboratory; the Medical Simulations Lab; and the Virginia Institute for Imaging and Vision Analysis (VIIVA).

The program also has strong ties to several other on- and off-campus laboratories, including the Applied Research Center at the Jefferson National Laboratory, the Center for Brain Research and Rehabilitation, the Frank Reidy Research Center for Bioelectrics, the Center for Bioelectronics, and the Virginia Modeling, Analysis and Simulation Center (VMASC). Regional, national, and international clinical collaborators support the program. These unique resources position the biomedical engineering program as a leader in education and research in the Southeast and nationally.

## Master of Engineering Admission Requirements

Admission to the Master of Engineering program in biomedical engineering is in accordance with Old Dominion University and Frank Batten College of Engineering and Technology requirements for master's programs as specified in this catalog. Specific additional requirements include the following:

1. Completion of a bachelor's degree in Engineering, Science or Mathematics from an accredited institution, although students from other educational backgrounds may apply with appropriate leveling courses. Accepted students from disciplines other than Biomedical Engineering will be required to complete a number of leveling courses to meet the prerequisites of the program; the Graduate Program Director will work with the admitted students to create the list of leveling courses, including calculus and differential equations.

2. A minimum GPA of 3.00 (out of 4.0) is required of most students. A student with a lower GPA meeting ODU's graduate admission requirements and with evidence of a high level of professional capability may be eligible for admission to the program upon submission of a petition to the graduate program director.
3. Recent scores, typically, not more than five years old, on the Graduate Record Examination's (GRE) verbal, quantitative, and analytical writing sections must be submitted by all applicants.
4. Two letters of recommendation (typically from faculty in the highest degree program completed when the application is within five years of graduation from that degree program) are encouraged but not required.
5. The applicant must submit a resume and a statement of purpose and goals.
6. Foundation knowledge in physics, basic chemistry, physiology, computer programming, and mathematics (including differential equations and statistics) is expected. Some leveling courses may be required to complement the student's expertise, namely in physiology, statistics, and differential equations.
7. The linked Bachelor's/Master's degree program in the Frank Batten College of Engineering and Technology at Old Dominion University is designed to provide an opportunity for exceptionally qualified engineering undergraduate students to obtain both a bachelors and a master's degree in Biomedical Engineering. Typically, undergraduate students apply at the end of their junior year for admission to the linked programs.

## Curriculum Requirements

The Master of Engineering program requires completion of 30 course credits, including 15 core: 9 CH Common Core course credits, a 3 credit Core Project BME 698, and one 3 credit Methods Core course (BME 720 for Computer-Assisted Medicine specialization path) OR BME 792 (for Biomechanics path) OR BME 726 (for Diagnostics and Therapies path). In addition, there is a requirement of 15 credits of technical elective course credits, which entail 9 credits of BME technical electives and 6 credits of approved technical electives. The ME program culminates in a comprehensive exam, with written and oral components, the contents of which are based on the student's Core Project.

BME Core		15
Complete the following Common Core courses (9 credits):		
BME 711	Biological Mechanisms for Biomedical Engineers	
BME 712	Engineering Fundamentals in Biomedicine	
BME 740	Regenerative Medicine	
Complete a 3 credit Core ME Project		
BME 698	Master's Project	
Complete one Methods Core Course (3 credits) from the following:		
BME 720	Modern Biomedical Instrumentation	
BME 726	Biomaterials	
BME 792	Biomechanics	
BME Technical Electives <sup>1</sup>		9
Complete 9 credits of coursework from the following BME options:		
BME 530	Therapy and Function Models for Medical Simulation	
BME 554	Introduction to Bioelectrics	
BME 562	Introduction to Medical Image Analysis	
BME 564	Biomedical Applications of Low Temperature Plasmas	
BME 612	Digital Signal Processing I	
BME 695	Topics in Biomedical Engineering	
BME 698	Master's Project	
BME 700	Cardiovascular Physiology	
BME 702	Biomedical Sciences Journal Club	
BME 710	Advanced Cell Biology	

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BME 714	Biomedical Sciences Laboratory
BME 721	Mathematical Modeling in Physiology
BME 730	Predoctoral Fellowship Grant Writing
BME 731	Finite Element Analysis
BME 741	Principles of Visualization
BME 747	Responsible Conduct of Research
BME 751	Computational and Statistical Methods in Biomedical Engineering
BME 754	Advanced Bioelectronics
BME 755	Biomembranes and Ion Channels
BME 760	Autonomous and Robotic Systems Analysis and Control
BME 762	Applied Medical Image Analysis
BME 770	Advanced Study in Biology
BME 775	Grant Writing in Biology
BME 783	Digital Image Processing
BME 785	Advanced Manufacturing Technology
BME 794	Cellular Biomechanics
BME 795	Special Topics in Biomedical Engineering
BME 797	Independent Study
<b>Approved Technical Electives <sup>1</sup></b>	
<b>6</b>	
Complete 6 credits of coursework from electives not necessarily listed above.	
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<b>Total Credit Hours</b>	
<b>30</b>	

<sup>1</sup> A total of 15 credits of technical elective courses can be selected from the biomedical engineering technical electives (9 credits) or a wide variety of appropriate graduate courses (6 credits) in engineering, biology, chemistry, psychology, computer science, modeling and simulation, mathematics, statistics, or other programs. Technical electives without the BME prefix must be approved by the graduate program director.