

Graduate Certificate in Biorobotics

Program Description

The Graduate Certificate in Biorobotics is a 12-credit interdisciplinary program that provides advanced, interdisciplinary training at the intersection of robotics, biomechanics, and artificial intelligence as applied to human health and biomedical systems. This program is designed to equip students with the technical knowledge and practical skills needed to develop, analyze, and implement robotic and intelligent systems in healthcare, rehabilitation, and biomedical device applications. Through a combination of theoretical foundations and hands-on learning, students will explore human movement, robot design and control, AI-driven analysis, and computational modeling. The curriculum emphasizes real-world applications, including prosthetics, rehabilitation technologies, and intelligent medical devices.

Who would be suited to take this program?

- **Engineers seeking to enter or advance in biomedical and biorobotics fields**, including those with backgrounds in electrical, mechanical, or robotics engineering.
- **Biomedical professionals and researchers** aiming to integrate robotic technologies into healthcare delivery, clinical decision-making, or laboratory applications.
- **Healthcare technology leaders and executives** who wish to deepen their understanding of biorobotic systems to improve patient outcomes, operational efficiency, and innovation.
- **Policymakers, regulators, and professionals in medical device industries** involved in the adoption, oversight, or ethical implementation of biorobotic technologies.

What will I learn?

Biomechanics of Human Structure and Motion - This course focuses on principles of engineering mechanics and materials science applied to human structural and kinematic systems and to the design of prosthetic devices. Topics include anatomy; human force systems; human motion; bioengineering materials; and design of implants, supports, braces, and replacements limbs.

Biorobotics - This course focuses on the basics of control of a robot and telemanipulation. Computer simulations and MATLAB are used to explore biomimetic autonomous robots. This is a studio-based course with hands-on exercises with small robots and actuators. Topics include understanding how biological robots (humans and animals) differ from designed robots, as well as sensors (touch, stereo and position), actuators (muscles, smart materials), and intelligent (neural- and computer-controlled) systems.

Computational Biomechanics - This course focuses on using computational methods and commercially available software, such as ANSYS, Fluent, and MATLAB, to solve complex engineering problems related to biomedical device industry. Suitable for students interested in Computer Aided Design and Engineering (CAD/CAE).

Introduction to Robotics - This course focuses on an introduction to the field of robotics, including analysis of robot geometries; kinematics of robot manipulators; path planning and sensor processing; introduction to multi-robot systems. Students should have competence in computer programming and familiarity with MATLAB.

Why study Biorobotics at NJIT?

Studying Biorobotics at New Jersey Institute of Technology offers students a unique opportunity to engage at the intersection of robotics, artificial intelligence, and human health within a highly applied, technology-driven environment. NJIT combines strong expertise in biomechanics, robotics, and AI with access to cutting-edge research initiatives and industry partnerships, including collaborations with healthcare and rehabilitation institutions. The university's location in the New York-New Jersey innovation corridor provides direct access to one of the nation's largest concentrations of biomedical and technology industries, supporting internships, research, and career placement opportunities. With a focus on hands-on learning, computational tools, and real-world applications, this program prepares students to contribute to emerging advances in rehabilitation, medical devices, and intelligent healthcare systems.

What are the Career Opportunities?

- * Biomedical Engineer (product design, management, validation, and regulatory compliance)
- * Biomechanics Data Scientist
- * Robotics Researcher in Healthcare Innovation
- * Health Informatics Specialist
- * Medical Device and Biotechnology Professional

In addition, holders of this graduate certificate may find employment in the following industries: healthcare, health sciences, biomedical engineering, medical device industry, pharmaceutical industry, FDA, USPTO, and other life science related industries

Prerequisites

An undergraduate degree in engineering, with an undergraduate cumulative grade point average (GPA) of at least 3.0 on a 4.0 scale is required. Applicants with a science degree and relevant industrial experience may be considered for conditional admission.

The Graduate Certificate in Biorobotics can be applied towards an MS in Biomedical Engineering (<https://catalog.njit.edu/graduate/newark-college-engineering/biomedical/ms/>). Students with an undergraduate degree in Biomedical Engineering may transfer all certificate courses with a minimum grade of B to the MS program. Students from other disciplines may apply up to two certificate courses towards the MS in Biomedical Engineering.

What are the Required Courses?

The Graduate Certificate in Biorobotics can be completed by taking four courses (12 credits). The requirements must be satisfied as indicated in the following Course List.

Code	Title	Credits
Core Courses		
BME 671	Biomechanics of Human Structure and Motion	
BME 673	Biorobotics	
BME 676	Computational Biomechanics	
ME 625	Introduction to Robotics	