# Mechanical Engineering
# BioMechanical Design

**MSc Programme**

**BioMechanical Design deals with the interaction of mechanical technology with biological systems. This means investigating human movement, perception, and control characteristics from a mechanical engineering perspective, and developing both the mechanical design skills and the knowledge of control theory necessary to develop robust and adaptive systems that can interact effectively with the messy, soft, and unpredictable world of human beings. In contrast to the more clinically oriented MSc programme in Biomedical Engineering, BioMechanical Design focuses on the engineering challenges of learning from biological systems for engineering applications.**

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| **Degree** | Master of Science in Mechanical Engineering |
| **Credits** | 120 ECTS, 24 months |
| **Language** | English |
| **Application deadline** | April 1st: international students |
| **Tuition fee** | € 18.750 (non EU)<br>€ 2.083 (EU) |
| **Scholarships** | scholarships.tudelft.nl |

## Programme

The first year consists of a set of courses common to all Mechanical Engineering tracks, a social or ethics course, track-specific courses, and individual electives. In the first weeks of the programme, you put together your own individual study programme. During the second year, you complete your MSc thesis project, preceded by a literature review and an internship, research assignment, joint interdisciplinary project, or extra elective courses. These projects are often in close collaboration with researchers at our faculty and part of cutting edge research and development projects.

## Topics

Students in the BioMechanical Design acquire a solid background in biomechanics, control systems, and mechanical design.

***Working With Biological Systems***

Until recently, powerful machines and robots were mainly found in industrial settings. But they are performing an ever wider variety of tasks in our society. The requirements for these systems are very different from those for industrial machines. Instead of accuracy and power, they require adaptability, safety, and a gentle touch. Physically interacting with humans out in the real world means operating in uncontrolled, unpredictable environments. Therefore, possible topics of study in BioMechanical Design include, for instance, robotic support systems, human motor augmentation, and prosthetics. You will learn how to design, simulate, and control robots, how to model the human body and brain as a control system, and how to create mechanisms that interact successfully with humans.

TU Delft

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| First year (60EC) | | |
|---|---|---|
| **Obligatory Courses MSc ME**<br>14-17 EC | **Obligatory Courses ME-BMD**<br>22 EC | **Design Project Courses**<br>Choose two or more |
| Physics for Mechanical Engineers | Control System Design | Bio Inspired Design |
| Nonlinear Mechanics | Human Robot Interaction | Compliant Mechanisms |
| Measurement Technology | Multibody Dynamics B | Bio Mechatronics |
| Ethics / Social Course | Neuromechanics & Motor Control | Precision Mechanism Design |
| | Musculoskeletal Modelling and Simulation | Medical Device Prototyping |
| **Recommended Electives / Specialization Courses**<br>Complete your individual study programme by choosing from these and other courses | | |
| **Robotics & Control** | **Biomedical Engineering** | **Engineering Design & Research** |
| Control Systems Lab | Anatomy and Physiology | 3D Printing |
| Knowledge Based Control Systems | Applied Experimental Methods: Medical Instruments | Freehand Sketching of Products and Mechanisms |
| Planning and Decision Making | Computational Mechanics of Tissues and Cells | Introduction to Engineering Research |
| Robot Software Practicals | Special Topics in Sports Engineering | System Identification and Parameter Estimation |

| Second year (60EC) | |
|---|---|
| **First Quarter Project**<br>Choose one option (15 EC) | **Graduation Project**<br>45 EC |
| Internship | Literature Study<br>10 EC |
| Joint Interdisciplinary Project | |
| Electives | MSc Thesis<br>35 EC |

***Learning From Biological Systems***

Probably the greatest diversity of mechanical designs is found in nature. For each challenge posed by an often hostile environment, a wealth of solutions has evolved. Inspiration from nature drives the search for innovative solutions in such fields as medicine, rehabilitation, microsystems, and mechatronics. The study of biological mechanisms can provide the inspiration for innovative solutions to what are often uncommon challenges. You will learn, for example, how to use springs and elastic materials to make lightweight and inherently safe constructions, and how to develop mechanical systems that naturally complement the behavior of humans and other biological systems. You will gain knowledge about innovative design approaches and study methods to translate biological working principles into technological solutions.

## Courses

The curriculum of the BioMechanical Design track (see table) is structured around three core topics: biomechanics, control systems, and mechanical design.

As part of the overall Mechanical Engineering programme, students are required to take the courses Physics for Mechanical Engineers, Measurement Technology, Nonlinear Mechanics, and at least one social or ethics course.

Within the BioMechanical Design track, students follow a core of compulsory courses specific to the track. These courses deal with control system design, human-robot interaction, human motor control, and human biomechanics. In addition, all ME-BMD students follow at least two design project courses where creative mechanical design projects are conducted in interdisciplinary teams.

To complete your individual course package, you can choose from an extensive list of electives. You can, for instance, choose to specialize in topics around robotics, control, and human motor augmentation, in biomedical applications such as prosthetics and the design of medical instruments, or build on the compulsory courses with a more general set of mechanical engineering electives.

## Career Prospects

The knowledge and skills obtained in the BioMechanical Design programme are highly regarded within the traditional mechanical engineering industries. Our graduates find jobs in all major industrial sectors, including management positions or technical project leadership roles in multinationals, positions in technical development, in industry and in academic medical centers, and as scientists in university or technology transfer institutions. A growing number of graduates set up their own businesses.

**90**
**new students per year**

**20%**
**of students are women**

**10%**
**international MSc students**