

# Electrical Engineering Biomedical Devices Profile

## MSc Programme



The Faculty of Electrical Engineering, Applied Mathematics and Computer Science at Delft University of Technology offers a broad Master's programme in Electrical Engineering. We offer four different tracks: Electrical Power Engineering, Microelectronics, Wireless Communications & Sensing and Signal and Systems, and offer one specialisation profile: Biomedical Devices.

The profile Biomedical Devices offers a specialisation profile for students following either the Microelectronics or Signal & System tracks. The specialisation focusses on: Biosensors, BioMEMS and Microsystem Integration or Biomedical Circuits and Systems when choosing it as a part of the Microelectronics track or Biomedical Signal Processing when choosing it as a part of the Signals and Systems track.

<b>Degree</b>	Master of Science
<b>Starts</b>	September
<b>Type</b>	full-time
<b>Credits</b>	120 ECTS, 24 months
<b>Language</b>	English
<b>Application deadline</b>	1 April (International BSc degree) 1 July (Bridging programme*) 1 September (Dutch BSc degree)
<b>Tuition fee</b>	€ 18.750 (non-EU) € 2.168 (EU)
<b>Scholarships</b>	<a href="https://www.tudelft.nl/scholarships">scholarships.tudelft.nl</a>

Biomedical Devices are devices for medical diagnosis, monitoring and treatment. They can be fixed, portable, wearable, implantable and injectable. Biomedical Devices are active and thus embed electronics, computing and software.

Examples of biomedical devices are:

- Magnetic Resonance Imaging (MRI), Computed Tomography (CT), Positron Emission Tomography (PET), Ultrasound (US) imaging;

- Monitors for pulse oximetry, blood pressure, glucose, electrocardiography (ECG), electro-encephalography (EEG), electro-myography (EMG), electro-corticography (ECoG), temperature, galvanic skin response, bio-impedance

### Programme

The Biomedical Devices profile is both part of the MSc EE-Microelectronics and MSc EE-Signals-and-Systems.

# Electrical Engineering Signals & Systems

First Year (60 EC)			
1 <sup>st</sup> quarter	2 <sup>nd</sup> quarter	3 <sup>rd</sup> quarter	4 <sup>th</sup> quarter
Profile Orientation & Academic Skills		Systems Engineering	
Core courses (common core and track specific core)	Core courses	Core courses	Core courses
		Specialisation courses	Specialisation courses
Specialisation courses	Specialisation courses	Free elective courses	Free elective courses
Second Year (60 EC)			
1 <sup>st</sup> quarter	2 <sup>nd</sup> quarter	3 <sup>rd</sup> quarter	4 <sup>th</sup> quarter
Specialisation courses	Graduation project (45 EC)		
Free elective courses			

For more information on all courses, please visit: [www.studyguide.tudelft.nl](http://www.studyguide.tudelft.nl)

## Subprofiles

There are three subprofiles: BioSemi (part of the track Microelectronics of the Electrical Engineering programme), BioCAS (part of the track Microelectronics of the Electrical Engineering programme) and BioSP (part of the track Signals & Systems of the Electrical Engineering programme).

### BioSemi: Biosensors, BioMEMS and Microsystem Integration

The BioSemi sub-profile concentrates on microfabrication of biosensors, bio-micro-electro-mechanical systems, micro-assembly, and complete biomedical devices on-chip for, e.g., organs on-chip, smart catheters, and flexible implants.

### BioCAS: Biomedical Circuits and Systems

The BioCAS sub-profile concentrates on circuits and systems for biomedical applications, such as 3D trans-esophageal echography, autonomous vital sign monitoring, transcutaneous and implantable closed-loop neurostimulators, and brain-machine interfaces

### Biomedical Signal Processing

The BioSP profile concentrates on biomedical signal processing and machine learning for single-transducer ultrasound imaging, low-field magnetic resonance imaging, combined functional ultrasound and EEG brain imaging, speech processing for hearing aids and cochlear implants, and detection and classification of cardiac arrhythmias.

## Master's Thesis

Graduation work can be done either at Delft University, or in industry and other (international) universities. Some examples of research topics as studies in the research groups involved are:

- Biosensors
- Smart catheters
- Organs on chip
- Electrodes and optrodes
- Flexible implants
- Transcutaneous US neuromodulators
- Power-efficient neurostimulation
- Wireless power transfer and energy harvesting
- Autonomous vital sign monitoring
- 3D trans-esophageal echography (TEE)
- Low-field MRI
- Combined functional ultrasound and EEG brain imaging
- Speech processing for hearing aids and cochlear implants
- Detection and classification of cardiac arrhythmias, e.g. AF

## Career perspective



### Companies

Philips, ASML, NXP, TNO, ASTRON, Ericsson, Siemens



### Positions

Excellent foundation for careers in research, development and consultancy, as well as for commercial and management positions