This program focuses on building complex systems with a strong multidisciplinary approach by integrating sensors, actuators, electronics, innovative materials and smart computational elements. In addition to their classes in micro-nano systems, optics, photonics and advanced manufacturing, students learn by designing, prototyping and validating complete miniaturized systems (from few centimeters to micrometer and nano-scales).
Quantum technology: from sensing to computing  
Prof. Edoardo Charbon

The capability of detecting single photons has many advantages; as it enables to quantitatively sense light and this is useful when bursts of light and therefore can determine important biophysical properties of the material the target is made of.

In order to do so efficiently and very quickly, the AQUA lab has developed single photon avalanche diodes (SPADs) capable of detecting photons in millions of pixels simultaneously, hundreds of thousands of times in a second.

But sensing is only one aspect involving the quantum paradigm. For instance, one can also use photons as quantum bits (qubits) to perform complex computations, using superposition and entanglement, two of the most elusive properties of quantum mechanics. One can also house qubits in quantum dots, where electronics cooled to a few degrees Kelvin, is used to program and control them. This is one of the most exciting quests of our time: building a scalable quantum computer to demonstrate quantum advantage on useful problems that are intractable on today’s supercomputers.

Optics and artificial intelligence

Prof. Christophe Moser and Prof. Demetri Psaltis

Light can also be used as a mean for computing. For example, fast, and power efficient deep neural networks can be realized by leveraging the complex transformation that light undergoes while propagating in optical fibers - the same type used for digital communication. The optical computer is a complex system that combines the many disciplines taught in the Microengineering Master’s program such as digital programming, control electronics that synchronize the light beams with high-speed cameras as well as light modulators and requires knowledge of non-linear optical phenomena.

The technique that was developed is known under the nickname SOLO and it has shown remarkable accuracy while carrying out the computation for several different tasks, such as detecting COVID infections in lungs X-rays. The optical computer has done this at a fraction of the energy consumption compared to electronic, digital implementations.

Creating artificial muscles

Prof. Yves Perriard

EPFL Center for Artificial Muscles (CAM) is becoming a leading reference for the development and clinical transfer of a brand-new technological approaches to artificial muscles in the human body.

One of their main project developed in collaboration with the Universities of Bern and Zurich focuses on an augmented aorta as a cardiac assist device.

To achieve this ambitious goal of an artificial heart, the CAM team developed various Microengineering technologies for high-power actuation (tubular dielectric elastomers), biocompatible materials, wireless energy transfer and step-up voltage modules as well as smart automated test-benches simulating the blood-flow.

Other projects developed in this Center include - an artificial sphincter to help patients suffering either from urinary incontinence or from an underactive bladder, and a flat, activated membrane to restore chewing function and facial expressions.
Master of Science in MICROENGINEERING

2-year program - 120 ECTS

Master’s thesis 30 ECTS
Project in social and human sciences 6 ECTS
Semester projects 20 ECTS
Options 39 ECTS

Industrial internship
The program includes a compulsory 8-week internship which can be extended to 6 months and/or combined with the Master’s thesis.

Students may organize their study plan around one of the following orientations:
- Optics and photonics
- Micro and nanosystems
- Production and advanced manufacturing

They may choose a 30 ECTS minor within the optional courses. Recommended minors with this program:
- Biomedical technologies
- Imaging
- Photonics

Admission criteria
EPFL Bachelor’s degree in Microengineering.
A Bachelor’s degree in Computer Science, Electrical Engineering, Mechanical Engineering, or any related field with an interdisciplinary background and an excellent academic record may also be accepted. However, candidates must master at least two of the three following fields: computer science, electronics, and mechanical engineering. Additional credits to fill any gaps may be required.

Career prospects
The EPFL MSc in Microengineering opens a broad range of career opportunities in research departments and manufacturing units over the entire industry spectrum, from start-ups to multinational groups. Microengineers are highly sought after in high-tech sectors, where their solid and broad profile empowers them to lead research and development, as well as to oversee production in industries ranging from aerospace and medtech to the watch industry.

School of Engineering
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