CC5 Micro and Nano Systems

LEARNING OBJECTIVES

The Micro and Nano Systems track allows students to comprehensively understand state-of-the-art micro and nanomanufacturing techniques, encompassing crucial processes like thin film deposition, lithography, and etching. The track further emphasizes the significance of characterization, testing, and reliability assessment in this engineering field while also addressing the specific requirements of production planning and control for large-scale manufacturing of these devices.
The track aims to develop strong skills in designing, modelling, and simulating micro and nano devices, with a particular focus on micro and nano robots as a prime example of integrated sensing, actuating, and control subsystems. Additionally, students will expand their knowledge of electronics and modern physics in this field.

PRE-REQUISITES

While no specific prerequisites are required for students opting for the Micro and Nano Systems track, a strong foundation in mathematics, including calculus and differential equations, as well as knowledge of basic physics and electronics concepts, would be beneficial. Programming skills, particularly in languages like MATLAB or Python, may also be advantageous for computer-based modelling and simulation.

LEARNING OUTCOMES

Students in the Micro and Nano Systems track will gain proficiency in designing and fabricating micro and nano devices, their modelling and simulation, their characterization and testing, as well as their system integration and application in various fields. Additionally, the track emphasizes skills in societal implications, effective communication and teamwork skills.

CC5 Micro and Nano Systems

JOB OPPORTUNITIES

Completing a Micro and Nano Systems track provides graduates with a wide range of job opportunities in both industry and research. The semiconductor industry offers abundant job opportunities: graduates can work on the fabrication and integration of microelectronic devices, such as integrated circuits, sensors, and actuators. Also, the biomedical and healthcare sectors greatly benefit from micro and nano systems: graduates can find job prospects in developing devices tailored for medical applications. Another area of opportunity lies within the energy sector: graduates can contribute to the development of micro and nano systems for energy harvesting, storage, and management. Finally, graduates with an entrepreneurial spirit can explore opportunities to start their own ventures. Leveraging their micro and nano systems knowledge, they can develop innovative products or services in areas such as microfluidics, nanomedicine, nanomanufacturing, and other emerging fields.

PARTNER UNIVERSITIES

There are consolidated collaborations in the field of Micro and Nano Systems with several renowned universities worldwide, such as Albert-Ludwigs-Universität Freiburg (UniFreiburg, Germany), Technische Universität München (TUM, Germany), Eidgenössische Technische Hochschule Zürich (ETH Zurich, Switzerland), Massachusetts Institute of Technology (MIT, USA), and University of California, Berkeley (UC Berkeley, USA). It's important to note that this list is not exhaustive, and there are many other universities worldwide with whom we collaborate in one form or another. The field is highly interdisciplinary, with research occurring in various countries across continents, providing ample opportunities for further exploration and collaboration.

CC5 Micro and Nano Systems

1 YEAR COURSES
60 ECTS

40 ECTS

	ECTS
Control of Mechanical Systems	10
Dynamics of Mechanical Systems	5
Machine Design	5
Measurements for Micro and Nano Systems	5
Production Planning and Control for Micro and Nano Production Systems	5
Semiconductor Device Manufacturing	5

10 ECTS

	ECTS
Elements of Modern Physics	10
Fundamentals of Electronics	10
Nonlinear Dynamics and Chaos	5

CC5 Micro and Nano Systems

2 YEAR COURSES

40 ECTS + 20 ECTS Master's Thesis

10 ECTS

	ECTS
Advanced Micro and Nanofabricarion Technologies	5
Micro and Nano Robotics	5

5 ECTS

	ECTS
Multi-Disciplinary Design Laboratory	5

CC5 Micro and Nano Systems

30 ECTS

	ECTS
MEMS Mechanics and Design - Actuators	5
MEMS Mechanics and Design - Sensors	5
Nanoelectronics of Graphene and Related 2D Materials	5
Semiconductor Qbits	5
Biochip	5
MEMS System and Electronics - Part I (Inertial)	5
MEMS System and Electronics - Part II (Magnetic, Acoustic, Imaging)	5
Sensors Sytems	5
Electron and Scanning Probe Microscopy	5
Integrated Photonics	5
Magnetism and Superconductivity	5
Meta Photonics	5
Nanomagnetism and Spintronics	5
Semiconductor Nanostructures	5

CC5 Micro and Nano Systems

	ECTS
Physics of Nanostructures	5
Ferroic Materials	5
Mechanical Testing at Small Scale	5
Mechanics of Materials and Inelastic Constitutive Laws	5
Smart Materials	5
Surface Treatment for Engineering Applications	5
Corrosion Engineering	5
Functional Materials	5
Fundamentals of Materials Science	5
Materials for Electronics	5
Nanostructured Materials	5
Viscoelastic Behaviour of Polymers	5
Micromechanics	5
Computational Modeling for Materials Engineering	5
Multiphysics Modelling and Simulation	5

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	ECTS
Advanced Digital Signal Processing - Part I	5
Advanced Digital Signal Processing - Part II	5
Advanced Programming for Scientific Computing - Part I	5
Advanced Programming for Scientific Computing - Part II	5
Model Order Reduction Techniques	5
Computational Statistics	5
Metamaterials and Metastructures	5