MICRO-611 **Nanoscale MOSFETs and beyond CMOS devices**

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Cursus	Sem.	Type
Electrical Engineering		Opt.
Microsystems and Microelectronics		Opt.

Language of teaching	English
Credits	1
Session	
Exam	Oral
Workload	30h
Hours	**14**
Lecture	14
Number of positions	**16**

Frequency

Every 2 years

Remark

Next time in Autumn 2025

Summary

This course provides the trends in nanoelectronics for scaling, better performances and lower energy per function. It covers fundamental phenomena of nanoscale devices, beyond CMOS steep slope switches, emerging architectures, cryo electronics, non-volatile memories and energy efficient smart sensin

Content

(1) Nanoscale CMOS technologies, technology boosters and potential showstoppers

(2) Phenomena specific to deep submicron devices:
- non-stationary phenomena (velocity overshoot)
- ballistic transport
- quantum effects
- atomic scale parameter fluctuation (fluctuation of number of dopants, interface roughness)

(3) Emerging multi-gate device architectures: Double-gate MOS transistor -DGMOS, nanowire gate-all-around transistor, vertical MOS transistors, 3D stacked multigate nanowire transistors

(4) Single Electronics : principle, technology, performance metrics, hybrid architectures
(5) Cryogenic electronics for quantum computing
(6) Beyond CMOS small swing switches for low standby power integrated circuits: tunnel FETs, phase-change switches, nano-electro-mechanical devices

(7) Emerging non-volatile memories: phase change memory, spin based memories, ferroelectric memory, polymer memory

(8) Carbon electronics: carbon nanotubes and graphene as new material options for functional diversification.

(9) Energy efficient smart sensing and computing for Internet-of-Things (IoT) with emphasis on wearable technology and its perspectives
(10) Integrated photonics to address the interconnect bottleneck

Keywords

Nanoscale MOSFET, beyond CMOS device, energy efficient devices, emerging memories, energy efficient computing and sensing for IoT

Learning Prerequisites

Recommended courses

Basic engineering courses in math, solid state physics or material science

Resources

Moodle Link

- https://go.epfl.ch/MICRO-611