

MICRO-614

**Electrochemical nano-bio-sensing and bio/CMOS interfaces**

Carrara Sandro

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

Contact language	English
Credits	1
Session	
Exam	Project report
Workload	30h
<b>Hours</b>	<b>15</b>
Lecture	15
<b>Number of positions</b>	<b>20</b>

**Frequency**

Every year

**Remark**

June 10-14, 2024

**Summary**

Main aim of the course is to introduce, in designing of modern wearable and implantable devices, the new concept of co-design three system' layers: Bio for Specificity, Nano for Sensitivity, and CMOS for autonomy. Recent examples of devices realised for m-Health are presented and deeply discussed.

**Content**

1. Bio for Probes/Targets building blocks: Proteins and DNA
2. Bio for Probes/Targets interactions with DNA and Antibodies
3. Bio for Probes/Targets interactions with Oxidases and Cytochromes
4. Bio for Detection principles: Dna, Antobodies, Enzymes
5. Bio for Detection principles: Redox Reactions
6. Nano for Probes immobilization: Methods and Mechanisms
7. Nano for Probes layer quality: SPR, SEM, and AFM
8. Nano for Memristive Biosensors
9. Nano to prevent the Electron Transfer
10. Nano to enhance the Electron Transfer
11. CMOS for metabolite in fixed voltage
12. CMOS for metabolite in scanning voltage
13. CMOS for multi-metabolites monitoring
14. CMOS for DNA detection
15. CMOS for Applications in Animals and Humans Remote Telemetry

**Keywords**

Wearable Devices; Implantable Chips; mHealth; Nano-Bio-Technology; Carbon Nanotubes; Metallic Nanoparticles; Op Amp; Analog Design; Electrochemical Sensing; CMOS

**Learning Prerequisites****Recommended courses**

Classical mechanics; Geometrical optics; Electro-magnetism; ohm law on steady current and some theorems on alternate current; Laplace transforms

**Assessment methods**

Home-works by solving excercises and writing a blog article

## Resources

### Bibliography

Bio/CMOS Interfaces and Co-Design, Sandro Carrara (author), Springer (Editor), 2011

### Ressources en bibliothèque

- [Bio/CMOS Interfaces and Co-Design / S. CARRARA](#)

### Moodle Link

- <https://go.epfl.ch/MICRO-614>