Introduction to analog CMOS design for Remote Biosensors on Chip. Understanding and designing of active and remotely powered biosensing systems.

**Content**

- Principles of biosensing: Target/Probe Interactions
- Electrochemical biosensing: three-electrode electrochemical cell and its equivalent circuits
- Basic CMOS configurations for electrochemical biosensing
- Voltage-ramp generators on chip
- Current readers: current-to-voltage and current-to-frequency conversion
- Wireless transmission in lossy media: issues on temperature, specific absorption rate (SAR) and efficiency
- Regulation aspects of wireless transmission close or in living matter: maximum value of the SAR and the temperature with respect to the frequency of operation and the body tissue.
- Power suppliers: non-rechargeable battery, rechargeable battery, super-capacitor, and storing capacitor
- Different types of remote powering coupling between control units and remote biosensors
- Passive (load modulation and backscattering) and active transmitters for RF communication
- System Configuration for remote powering operation and data communication.

**Keywords**

OpAmp, CMOS, biosensors, RF communication, Remote powering

**Learning Prerequisites**

**Required courses**

- Electronics I and II

**Learning Outcomes**

By the end of the course, the student must be able to:

- Design complete devices for remote biosensing at system level
- Design simple analog circuits for the biosensor frontend
- Design simple analog circuits for the RF data communication
- Design simple analog circuits for the remote powering operation
- Assess / Evaluate appropriate sources of information

**Teaching methods**

- Ex cathedra, and exercises

**Resources**
Ressources en bibliothèque

• Bio/CMOS interfaces and co-design / Carrara
• Design and optimization of passive UHF RFID systems / Curty

Notes/Handbook
1. Course slides on moodle intranet