

EE-442

**Wireless receivers: algorithms and architectures**

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Cursus	Sem.	Type
Electrical Engineering		Opt.
Electrical and Electronical Engineering	MA1, MA3	Obl.
Electrical and electronic engineering minor	H	Opt.
MNIS	MA3	Opt.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	During the semester
Workload	120h
Weeks	14
<b>Hours</b>	<b>4 weekly</b>
Courses	2 weekly
Exercises	2 weekly
<b>Number of positions</b>	

**Summary**

The students will learn about the basic principles of wireless communication systems, including transmission and modulation schemes as well as the basic components and algorithms of a wireless receiver. They develop an understanding for the wireless channel and system performance and limitations.

**Content****Fundamentals**

Baseband and passband signals, digital modulation, vector-space representation, matched filtering, maximum-likelihood estimation, performance metrics

**Synchronized receiver**

Carrier frequency and sampling frequency offset, time- and frequency synchronization, interpolation, equalization, diversity receiver

**The wireless channel**

Basic AWGN channel, signal propagation and attenuation, fading channels, multipath propagation, Doppler shift

**Wideband modulation**

Multicarrier communication, orthogonal frequency division multiplexing (OFDM), training based channel estimation and equalization for OFDM, synchronization, tracking, some OFDM based communication standards

**Final PROJECT: Acoustic OFDM transceiver**

We built an acoustic communication system based on OFDM as final project.

**Keywords**

Wireless, Communications, Wireless Channel, Digital Receiver, OFDM

**Learning Prerequisites****Important concepts to start the course**

Fundamentals of signal processing (FFT, LTS, filters, linear algebra, basic probability calculus)

**Learning Outcomes**

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

- Construct a basic wireless transmitter
- Explain the performance limitations of a wireless system
- Derive basic optimum receiver structures
- Develop a simulation model of a wireless system

- Develop a basic OFDM communication systems

### **Transversal skills**

- Make an oral presentation.
- Use a work methodology appropriate to the task.

### **Teaching methods**

Ex-cathedra lectures, computer labs using MATLAB, a final hands-on project

### **Assessment methods**

Mid-term exam (theory and MATLAB) & Final Project (acoustic OFDM transceiver)

### **Resources**

#### **Moodle Link**

- <https://go.epfl.ch/EE-442>

### **Prerequisite for**

EE-543 Advanced Wireless Receivers