EPFL

COM-415 **Audio and acoustic signal processing**

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Cursus	Sem.	Type
Computer science	MA1, MA3	Opt.
Cybersecurity	MA1, MA3	Opt.
Data Science	MA1, MA3	Opt.
Data science minor	H	Opt.
Digital Humanities	MA1, MA3	Opt.
SC master EPFL	MA1, MA3	Opt.

Language of teaching	English
Credits	5
Session	Winter
Semester	Fall
Exam	Written
Workload	150h
Weeks	14
Hours	**5 weekly**
Courses	2 weekly
Exercises	2 weekly
TP	1 weekly
Number of positions	

Summary

The objective of the course is to introduce theory, methods, ans basic psychoacoustics that is needed to understand state-of-the-art techniques used in pro audio and consumer audio, including microphones, surround sound, mixing and audio coding.

Content

• Acoustics and audio is covered and the manipulation and processing of audio signals. It is shown how Fourier analysis of a sound field yields the representation of the sound field with plane waves. These and other acoustic insights are used to explain microphone techniques and reproduction of sound fields.

• Psychoacoustics, loudness perception and spatial hearing are covered in detail. The latter is used to motivate stereo and surround mixing and audio playback. Audio playback is put into contex with a detailed coverage of room acoustics.

• The short-time Fourier transform is introduced as a tool for flexible manipulation of audio signals, such as filtering, delaying and other spectral modification. Matrix surround, audio coding, and beamforming are also treated.

Learning Prerequisites

Recommended courses

Signal processing for communication, any course on Signals and Systems

Learning Outcomes

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

• Apply basics of acoustics, signal processing, reproduction and capture

• Understand and implement linear and adaptative filtering, beamforming, noise suppression, audio coding, stereo and multichannel sound capture and reproduction

Teaching methods

In class ex-cathedra + exercices + mini-project supervision

Expected student activities

• Theoretical and practical exercises

• Mini-projects : individual or in small groups

Assessment methods

• Final exam
• Midterm exam
• Mini-project

Supervision

Office hours	Yes
Assistants	Yes
Forum	Yes