

EE-548

Audio engineering

Lissek Hervé

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

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	Written
Workload	120h
Weeks	14
Hours	4 weekly
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Summary

This lecture is oriented towards the study of audio engineering, room acoustics, sound propagation, and sound radiation from sources and acoustic antennas. The learning outcomes will be the techniques for microphones and loudspeaker design, as well as room acoustics.

Content**I Audition**

1. The human hearing system
2. Introduction to psychoacoustics
3. Basics on noise control engineering

II Room Acoustics

1. Wave theory
2. Geometrical room acoustics
3. Statistical (Sabine) room acoustics

III Electroacoustics analogies: application to transducers and wind instruments

1. A brief reminder on electroacoustics
2. Electroacoustic transducers
3. Application to wind instrument design

IV Microphones

1. General properties
2. Microphones theory
3. Microphone realization

V Loudspeaker design

1. The electrodynamic loudspeaker
2. Loudspeaker system design (enclosures)
3. Loudspeaker realization

VI Electroacoustic absorbers**Keywords**

Auditory system
 Psychoacoustics
 Room acoustics
 Electroacoustics
 Electroacoustic transducers
 Wind instruments
 Microphones
 Loudspeakers

Learning Prerequisites

Required courses

General physics
Circuits and systems

Recommended courses

Electroacoustics

Important concepts to start the course

Electrotechnics: transfer functions, impulse response, electric system characterization, filtering, bode representation
Transmission lines: wave propagation equations in 1D, circuit modeling, Kirchhoff theory

Learning Outcomes

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

- Analyze the auditory system from the physical viewpoint
- the perceptive hearing phenomena through objective measures
- a room with respect to acoustic quality criteria
- room acoustics performance
- Synthesize microphones and loudspeaker systems out of specifications
- acoustic/electroacoustic specifications from room acoustics requirements
- Analyze microphone and loudspeaker systems
- Analyze sound propagation in wind instruments

Transversal skills

- Use a work methodology appropriate to the task.
- Set objectives and design an action plan to reach those objectives.

Teaching methods

Ex cathedra lectures
Specialized seminars on side topics
Exercises in groups
Practical work, including numerical simulations

Assessment methods

Final written exam.

Resources**Bibliography**

M. Rossi, Audio, Presses Polytechniques Universitaires Romandes, 2007
H. Kuttruff, Room Acoustics, Spon Press, 4th edition, 2003

Ressources en bibliothèque

- [Audio / Rossi](#)
- [Room Acoustics / H. Kuttruff](#)

Notes/Handbook

Available on the Lab website (upload on a weekly basis).

Websites

- <http://lts2.epfl.ch>

Moodle Link

- <https://go.epfl.ch/EE-548>

Prerequisite for

Master projects, PhD thesis.