

EE-548

Audio

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Cursus	Sem.	Type
Génie électrique et électronique	MA1, MA3	Opt.
Microtechnique	MA1, MA3	Opt.

Language	English
Credits	3
Session	Winter
Semester	Fall
Exam	Written
Workload	90h
Weeks	14
Hours	3 weekly
Lecture	2 weekly
Exercises	1 weekly

SUMMARY

This lecture is oriented towards the study of audio engineering, with a special focus on room acoustics applications. The learning outcomes will be the techniques for microphones and loudspeaker design, as well as room acoustics knowledge.

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 Transducers for audio

1. A brief reminder on electroacoustics
2. Electrodynamic transducers
3. Electrostatic transducers
4. Piezoelectric transducers

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
Microphones
Loudspeakers

LEARNING PREREQUISITES**Required courses**

General physics
Circuits and systems

Recommended courses

Electroacoustics
Radiation and antennas

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

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. Kutruff, Room Acoustics, Spon Press, 4th edition, 2003

Ressources en bibliothèque

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

Notes/Handbook

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

Websites

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

PREREQUISITE FOR

Master projects, PhD thesis.