COURSE DESCRIPTION CARD - SYLLABUS

Course name
Technical Acoustics [N2AiR1-SW>AT]

Course

Field of study
Automatic Control and Robotics

Year/Semester
1/2

Area of study (specialization)
Vision Systems

Profile of study
general academic

Level of study
second-cycle

Course offered in
polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
20

Laboratory classes
20

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

dr Szymon Drgas
szymon.drgas@put.poznan.pl

dr inż. Andrzej Meyer

Lecturers

Prerequisites

Knowledge: The student starting this course should have the knowledge and ability to solve basic problems in mathematics, physical acoustics, digital signal processing. Skills: The student should be able to obtain information from the indicated sources, as well as understand the need to expand his competences and be ready to cooperate in a team. Social Competences: The student should show such features as: honesty, responsibility, perseverance, cognitive curiosity, creativity, personal culture, respect for other people.

Course objective

1. To provide students with basic knowledge about the structure and principles of operation of electro-acoustic devices, the implementation of sound recordings, as well as elements of hearing physiology. 2.Developing students skills in solving technical problems such as: qualitative and quantitative description of phenomena related to electroacoustics, carrying out measurements of specific acoustic and electrical quantities and determining the relationship between them, verification of the obtained results on the basis of theoretical knowledge. 3. Shaping teamwork skills in students - the ability to cooperate in the organization of acoustic measurements and in the preparation of final research reports.

Course-related learning outcomes

Knowledge
A student:
1. understands the methodology of designing specialized analog and digital electronic systems - [K2_W4]
2. has extensive knowledge of modeling and identification of systems - [K2_W5]
3.has detailed knowledge of the construction and use of advanced sensory systems - [K2_W6]
Skills
A student:
1. is able to simulate and analyze the operation of complex automation and robotics systems as well as plan and carry out experimental verification - [K2_U9]
2. is able to configure the electroacoustic track and select its parameters to the requirements of the facility being sounded - [-]
3. is able to record multitrack music material and record a CD-Audio - [-]
Social competences
A student is aware of the importance and understands the non-technical aspects and effects of engineering activities, including its impact on the environment and the related responsibility for decisions made - [K2_K2]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Formative assessment:
1) in the field of lectures:
based on answers to questions about the material discussed in previous lectures,

2) in the field of laboratory classes:
on the basis of the assessment of the current progress in the implementation of tasks.
Summative assessment:
1) in the field of lectures, verification of the assumed learning outcomes is carried out by:
a.assessment of the knowledge and skills shown in the problem-based written test - the test covers 4 tasks, the maximum number of points is 10, and the number of points required for a satisfactory grade is 6,
b. discussion of the test results,
2) in the field of laboratory classes, verification of the assumed learning outcomes is carried out by:
a. assessment of the student's preparation for individual laboratory classes ("entrance" test) and assessment of skills related to the implementation of laboratory exercises,
b. continuous assessment, during each class (oral answers) - rewarding the increase in the ability to use the learned principles and methods,
c. assessment of team work skills,
d. evaluation and "defense" by the student of the reports on the implementation of the laboratory exercise.
Obtaining additional points for activity during classes, in particular for:
1. Discuss additional aspects of the issue,
2. Effectiveness of applying the acquired knowledge while solving a given problem,
3. The ability to cooperate as part of a team practically carrying out a detailed task in the laboratory,
4. Remarks related to the improvement of teaching materials,
5. Identifying students' perceptual difficulties, enabling the ongoing improvement of the teaching process.

Programme content

The lecture program includes the following topics:
1. Classification of sound signals, objective quantities describing the sound
2. The human auditory system
3. Basics of psychoacoustics

4. Microphones and their characteristics
5. Elements of interior acoustics
6. Microphone-line preamplifiers
7. Selected DSP algorithms of audio signals
8. Analog and digital sound equalizers
9. Acoustics of speech

10. Algorithms for processing speech signals
11. Linear and pulse power amplifiers
12. Machine learning for sound signals
13. Loudspeakers and loudspeakers systems
14. Psychoacoustic models
15. Summary, final test
Laboratory classes are conducted in the form of 14 2-hour lab exercises, preceded by a 2-hour instructional session at the beginning of the semester. Exercises are carried out by 2-person teams.
The program of laboratory classes includes the following topics:
1. Instructional session
2. Measurement of microphone characteristics
3. Measurement of the microphone preamplifier parameters
4. Measurement of acoustic parameters of the room
5. Simulation of room acoustics
6. Study of frequency discrimination
7. Study of binaural differences in the level of masking
8. Measurement of the characteristics of sound equalizers
9. Measurement of audio power amplifier parameters
10. Speaker impedance measurement
11. Adaptive filtering
12. Speech signal analysis
13. Multitrack recordings of a musical work
14. Speaker and speech recognition
15. Final test

Teaching methods

1. Lecture: multimedia presentation, presentation illustrated with examples given on the board, solving problems
2. Laboratory classes: practical exercises, conducting experiments, team work

Bibliography

Basic
1. Cyfrowe przetwarzanie dźwięku, Haines R., Wydawnictwo MIKOM, Warszawa, 2002
2. Zasady nagłaśniania pomieszczeń i przestrzeni otwartej, Hojan E., Wydawnictwa Naukowe UAM, Poznań, 1988
3. Głośniki i zestawy głośnikowe, Krajewski J., WKŁ, Warszawa, 2003
4. Dźwięk i jego percepcja - aspekty fizyczne i psychoakustyczne, Ozimek E., PWN, Warszawa-Poznań, 2002
5. Podstawy nagłośnienia i realizacji nagrań, Sztekmiler K., Centrum Animacji Kultury, Warszawa, 2001
6. Podstawy elektroakustyki, Żyszkowski Z., WNT, Warszawa, 1984
Additional
1. Połączenia - podstawy profesjonalnej elektroakustyki i nagłośnienia, Butler T., FENDER
2. Przetworniki elektroakustyczne, Dobrucki A., WNT, Warszawa, 2007

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	40	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	60	2,50