



Course program

Acoustics VTAN01 (7,5 hp) – Autumn semester 2021

Purpose and content

The purpose of the course in acoustics is to provide knowledge of sound propagation in the air and in vibrating systems of solid structural elements. Fundamental properties and phenomena involved (i.e. generation, transmission, radiation, reflection and absorption) are introduced.

The topics of building acoustics and room acoustics are extensively presented from a practical and theoretical point of view, namely introducing existing calculation models and measurement techniques to address insulation and noise issues. Additionally, regulations and standardization (ISO defined measurements) are presented and connected to the acoustics theory in order to prepare students for the acoustics industry.

Emphasis is put into hands-on experience: performing and evaluating sound measurements as well as understanding the real-case applications of them. Guest lectures from professional acousticians are also provided to bridge the gap between theoretical approaches and industrial practices.

Literature and resources

Lecture notes and distributed written materials.

Course website: <http://www.akustik.lth.se/utbildning/kurser/vtan01-akustik-acoustics/>

Teachers – Engineering Acoustics

Nikolas Vardaxis (NV), nikolas.vardaxis@construction.lth.se
laboratory sessions

Course responsible, lectures,

Cecilia Sandstedt (CS), cecilia.sandstedt@construction.lth.se

Course administration

Examination

The course will be examined as follows:

- A project task that will be solved practically and is presented in a “popular-science video” presentation.
- A written exam mostly consisting of problems similar to those from the exercise sessions (calculator and handed out formulae summary are allowed).
- Attended and performed laboratory exercises along with written reports of the results.
- The project task and the exam are both given the grade: “u”, “3”, “4” or “5”, where “u” means not-passed. The final grade is obtained by both grades as: project (50%) / exam (50%).
- The lab reports are compulsory to hand in; then pass (not graded) or returned for completion until passed.

For passing the course, the project, the written exam and all laboratory reports must be passed.

Learning outcomes

- The learning outcome of the laboratory exercises is to be able to apply provided theoretical models or relations and to provide a solution to a given problem with instructions. Therefore, the laboratory exercises are presented to the students as tasks or problems to be solved. To do so, different theoretical aspects or



models are to be applied and illustrated by solving structured and well defined problems. In the lab report the relations used and theory behind are to be described and the results given along with estimated errors.

- The written exam contains some theoretical questions but mainly problems similar to those solved during the exercise sessions. The learning outcome is to have knowledge and understanding of the acoustics foundations and phenomena.
- The purpose of the project is to show that the students are able to model and analyse a problem with the tools, models and theories that are introduced during the course. The specific content of the projects is for the students to decide together with the teachers. The final output of the project is in the form of a video presentation, explaining in a popular scientific way the task and the problem solving approaches. The project prepares the students for the real world, where rather complicated tasks should be explained to others in a simple way.

Laboratory exercises

The course contains two laboratory exercises that will be performed:

Lab No.	Content	Date of lab session
1.1	Individual preparation tasks for Lab 1	Friday, November 5 th
1.2	Recording, calibration and evaluation of sound	To be announced
2	Sound insulation	To be announced

The laboratory exercises take approximately 2 hours to carry out on site. In addition, time will be needed for preparation, calculations, analysis and writing a laboratory report. As the laboratory sessions take place outside the regular course schedule of lectures and exercises, plenty of alternatives with different time slots will be offered to the students to perform the needed measurements during the corresponding week of the lab.

Project task

Different options will be proposed as possible topics for the project tasks. Likewise, students will also be able to suggest other alternative topics to the teachers which may be accepted. The project tasks will be introduced in the course at week 5 and final presentations take place on Wednesday, December 15th.

Bibliography

- [1] T.E. Vigran. *Building Acoustics*. Taylor & Francis Group, 2008. (Main literature)
 - [2] A.D. Pierce, *Acoustics: An Introduction to Its Physical Principles and Applications*, 3rd Ed., Springer, 2019.
 - [3] L. Cremer, M. Heckl and B. A. T. Petersson, *Structure-Borne Sound*, Springer, 2005.
 - [4] O. A. B. Hassan, *Building Acoustics and Vibration*, World Scientific, 2009.
- + Lecture notes & Handed out material during class

Weekly schedule

The course takes place on Wednesdays 08:15 -10:00 (Lecture) and 15:15-17:00 (Exercise session) and Fridays 08:15-10:00 (Lecture). The lecture room is not always the same - please check the Time Edit schedule before each case! Additional time for self-study will be required, as well as to perform group project tasks and manage laboratory sessions and exercises.



Timetable

Week	Date	Course program	Running Priority
1	03/11	- <u>8-10</u> : Course introduction & Basic acoustics I	Fix groups + schedule lab sessions
	03/11	- <u>15-17</u> : Exercise 1	
	05/11	- <u>8-10</u> : Basic acoustics II + Measurement Techniques - Introduction Lab 1.1 individual preparation	
2	10/11	- <u>8-10</u> : Wave Propagation	Lab 1.1 individual task Thursday
	10/11	- <u>15-17</u> : Exercise 2	
	12/11	- <u>8-10</u> : Room Acoustics 1 - Introduction Lab 1.2 group session - Lab 1.2 group session (all day slots)	
3	17/11	- <u>8-10</u> : Building Acoustics 1	Lab 1.2 slides hand in Thursday
	17/11	- <u>15-17</u> : Exercise 3	
	19/11	- <u>8-10</u> : Building Acoustics 2	
4	24/11	- <u>8-10</u> : Room Acoustics 2 - Introduction Lab 2 group session	Lab 2 session
	24/11	- <u>15-17</u> : Exercise 4 + Lab 1 comments	
	26/11	- <u>8-10</u> : Building Acoustics 3 - Lab 2 group session (all day slots)	
5	01/12	- <u>8-10</u> : Room Acoustics 3 - Project introduction	Lab 2 report hand in Friday
	01/12	- <u>15-17</u> : Exercise 5	
	03/12	- <u>8-10</u> : Guest lecture: Acoustics in the industry	
6	08/12	- <u>8-10</u> : Calculation methods	Project preparation
	08/12	- <u>15-17</u> : Exercise 6 + Lab 2 comments	
	10/12	- <u>8-10</u> : Building Acoustics 4 (Guest lecture)	
7	15/12	- <u>8-10</u> : Consultation (project or exams) - <u>15-17</u> : Project presentation	Project presentation
	17/12	- <u>8-10</u> : <i>Exercise + exams RECAP</i>	
Exam	11/1	- Exam (Ed 25, Ed 26), 14:00-19:00	