

Syllabus for Introduction to Sound and Vibration (ISV)

aka Ljud och vibrationer, introduktionskurs, VTA121, Lp III läsår 2016/2017, 7.5 hp

Teachers

Lectures and course administration: Patrik Höstmad, patrik.hostmad@chalmers.se

External lecturer: Pontus Thorsson (Akustikverkstan)

Lab. work and project work part 1: Julia Winroth, julia.winroth@chalmers.se + tba

Project work part 1-4: Julia Winroth, julia.winroth@chalmers.se

Course webpage

www.ta.chalmers.se — Education — Course Pages — Introduction to Sound and Vibration. The course page includes contact information, notice board, and documents and files to download. User name and password are required.

Course literature

Lecture notes and others are available at the course page in pdf-format.

Scheduled time

Normally 2 times 3 hours a week containing lectures, calculation demonstrations, and supervision of project work.

Examination

To pass the course and obtain the final grade the following must be achieved:

- (i) attended laboratory work and approved laboratory work,
- (ii) approved and graded reports of all parts of the project work, and
- (iii) approved and graded written exam.

The average grade from project work and the grade of the written exam are weighted equally (50%/50%) to obtain the final grade of the course.

Project work and laboratory work

Project work will be carried out during the course. General information needed for the work and supervision will be available at the lectures. The four parts in the project work will train you in working with problems that are typical in the sound and vibration field. Analysis of problems will be made by hand calculations and by using the software Matlab/Octave. The parts of the project work should be reported during the course via written engineering reports. Report deadlines are one to two weeks after the presentation of each part. The reports will be graded. The laboratory work will be combined with project work part 1 and is aiming at giving you a natural feeling for sound pressure levels and frequency characteristics of sounds. It treats also basic measurement technique and analysis of data. The laboratory work will be held starting Friday Study Week 1 (Lv1) and during Study Week 2 (Lv 2) and booking lists are posted in Study Week 1 (Lv1).

Written exam

Basic knowledge and understanding will be evaluated in a written exam. The exam is made without other aids than mathematical handbooks (e.g. Mathematics Handbook for Science and Engineering) and approved simple calculator. At least 30 points of 60 is needed to pass the written exam and obtain grade 3, at least 40 points for grade 4, and at least 50 points for grade 5.

Preliminary schedule, Lv — Study Week (Läsvecka), L — Lecture, P — Project work

Lv	L/P	Contents
1	L	Introduction Sound pressure. Acoustic measures: SPL, rms, Leq, levels, ... Complex notation of harmonic signals. Freq. domain: Spectra, 1/3-octave and octave bands, A-,B-, and C-weighting.
1	L	Sound waves and acoustical sources Sound waves in air.
1	P	<i>Introduction to the project work. Presentation of Part 1: Using complex numbers to solve acoustic problems. Laboratory work, time and frequency analysis of sound, interpretation and presentation of sound related results.</i>
1		Laboratory work Friday Study Week 1. See separate booking list.
2		Laboratory work during Study Week 2. See separate booking list.
2	L	Sound waves and acoustical sources Properties of elementary acoustic sources: Point source (monopole), line source (coherent/incoherent).
2	L	Physical phenomena influencing sound propagation Damping, reflection, scattering, diffraction, refraction. Snell's law.
2	P	<i>Consultation of project work. Presentation of Part 2: Exhaust system: Estimation of pipe termination source strength and contribution to SPL in compartment</i>
3	L	Sound propagation outdoors Metrology, ground effect, screens
3	L	Waves and vibrations on solids Wave equations for solids: Longitudinal waves, Bending waves. Vibration of structures: Bending waves on finite plates, Response of structures.
3	P	<i>Consultation of project work.</i>
3	!	Report deadline Project Work Part 1
4	L	Sound radiation from structures Radiation efficiency of infinite/finite plates
4	L	Vehicle acoustics and community noise Vehicle acoustics in general and development trends, Silencers, Road traffic noise and city planning
4	P	<i>Consultation of project work. Presentation of Part 3: Road traffic noise (Nordic prediction method)</i>
4	!	Report deadline Project Work Part 2
5	L	Vibration isolation and noise reduction treatments Vibration isolation, Blocking mass, Damping treatments, Heavy layers, Active noise and vibration control
5	L	Sound fields in cavities Wave description: Resonances/Eigen-frequencies/Mode shapes.
5	P	<i>Consultation of project work.</i>

Lv	L/P	Contents
6	L	Sound fields in cavities Statistical description: Energy balance, Reverberation time / Damping in cavities, Direct / diffuse field.
6	L	Sound insulation Reduction index. Sound insulation by infinite plates.
6	P	<i>Consultation of project work. Presentation of Part 4: Vibration isolation of engine. Sound insulation of firewall or sound insulation properties of lightweight concrete constructions.</i>
6	!	<i>Report deadline Project Work Part 3</i>
7	L	Sound insulation Sound insulation by finite plates, corrugated plates, and double walls.
7	L	Building Acoustics (Pontus Thorsson) Practical issues in building acoustics.
7	P	<i>Consultation of project work</i>
8	L	Absorbers Porous-, Resonance-, and Membrane-absorbers, Helmholtz-resonators, Kundt's tube.
8	L	Summary / Extra time / Questions for the exam
8	P	<i>Consultation of project work</i>
8	!	<i>Report deadline Project Work Part 4</i>