

Course PM/syllabus for:

Urban acoustics, ACE195, 7.5 ECTS

Chalmers International Master Programme in Sound & Vibration (MPSOV)

Quarter 4: 2024

Course: **Urban acoustics**

Dear student,

The **main goals** of the course are to understand the role and potential qualities of sound and vibration within planning of urban and rural areas as well as to understand the existing engineering prediction methods for community noise and ground vibrations, and to be able to critically judge their use within planning.

The **learning outcomes** are as follows. *After completion of this course, the student should be able to:*

- Describe acoustic qualities within urban planning
- Explain the physics behind sound propagation outdoors
- Explain the main properties of environmental acoustics sources
- Explain in detail the sources of road traffic and of rail traffic
- Apply advanced models and tools for the prediction of sound propagation outdoors
- Describe and utilise standards in the field of sound propagation outdoors
- List typical solutions for urban sound planning and their effect in terms of sound pressure level, sound quality and the functioning of urban spaces
- Describe the relation between the concerns and requirements of urban development, traffic planning, transportation noise and ground vibrations.
- Summarise the behaviour of the wave types and wave propagation in ground vibrations and its practical consequences
- Interpret measured data and perform calculations to evaluate ground vibrations in urban planning
- Consider sound and vibration in urban planning using a systematic process
- Compare and evaluate different planning options for an urban development site with respect to sound and vibration
- Develop, recommend and motivate an urban design idea for an urban development site, especially with respect to soundscape, noise, ground vibrations and mobility solutions

Hope you will enjoy the course!

Teachers:

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Schedule:

The planned schedule and content are listed below. Updates during the course will be shown in the common schedule, the TA web calendar: www.ta.chalmers.se/education/schedules (look for "URB")
(The course follows block schedule C.)

Lectures and in-class exercises:

According to the schedule. (Updates published in the common schedule, see above.)

Lecture room:

The lecture room at Applied Acoustics. Some lectures will be given on Zoom (links will be provided on Canvas and in the TA web calendar).

Course literature:

Material developed by the teachers.

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Project:

The project is presented orally and as a report. The project is made as a group work with the addition of an individual logbook.

Examination:

Written exam and project (4 + 3.5 ECTS). Written exam at end of course (formula sheet and calculator are allowed): grades 3, 4 and 5 correspond respectively to 15, 20 and 25 of the exam's maximum 30 points. The project is also graded (3, 4 and 5 corresponding to percentages 40, 60 and 80). To pass the course, the written exam as well as the project assignment need to be passed. The total grade for the course is given by a weighted average of the points of the two parts. Mandatory parts of the project include, on an individual level, a visit to the project site filling in an acoustic survey questionnaire and updating the logbook and, on a group level, completing hand-in tasks during the course, giving a final presentation of the project and uploading the final project report and presentation slides.

The scheduled content is listed below as one table per week (for date and time updates see the TA web calendar)

Below each table the weekly content of the planned Project work is indicated (including expected student working time)

Study week 1			
Date	Activity	Teacher	Study materials
March 18 13:15-15:00	Lecture (1, Intro) – Introduction to the course, course info and info on the project – Introduction to planning and the role of acoustics – Examples from previous research projects	JF	Prepared by JF
March 18 15:15-16:00	Lecture (2, Intro, contd) – Introduction to the project	JF	Prepared by JF
March 21 08:00-09:45	Lecture (3) – Introduction to outdoor sound propagation and community noise. – Description of layout of engineering noise mapping model, exemplified by the Nord2000 model – Exemplifying Engineering models (CNOSSOS-EU, Harmonoise, Nord2000, ISO-9613) – Introducing road source models and the model suggested for use in the project	JF	Prepared by JF
March 21 10:00-11:45	Project Workshop – Introduction to project, continued (JF) – Getting started with the project and preparation for site visit	JF	Prepared by JF
March 22 15:15-17:00	Project Workshop – Site visit and inventory	FD	Prepared by JF, FD (questionnaire)

Project content (student working time: 8 h)

- Info about the project site, aim of project, regulations, stakeholders
- City of Gothenburg's guide to sound planning
- Student work:
 - Inventory of existing documents (noise maps, traffic noise inventories, traffic flows, future plans of traffic, etc.)
 - Start on the Logbook
 - Site visit/Questionnaire/Measure with sound level meter

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Study week 2			
Date	Activity	Teacher	Study materials
March 25 13:15-15:00 *View uploaded videos with derivations before lecture	Lecture (4) – Relation between sound power level and sound pressure level* – How to calculate SPL and SPL re free for a point source above hard ground* – Relation between sound power level of each vehicle and sound power level per unit length – Source model of Nord96 (and comparison with Nord2000) – Equivalent and maximum levels – Presentation of Hand-In Task 1 (HIT1)	JF	Prepared by JF
March 25 15:15-16:00 (with teacher) 16:00-17:00 (without teacher)	Project Workshop , Group work with supervision – Work on 'where to place what?', make initial sketches	FD, JF	

Project content (student working time: 8 h)

- Analysis and conclusion on outcomes of the site visit: questionnaire results, measured noise levels, relation to building regulation, variation within the area, etc.; working on 'where to place what?'
- Work with noise mapping software
- Update the Logbook and hand in
- Work on Hand-In Task 1 (HIT1)

- EASTER BREAK -

Chalmers University of Technology
Applied Acoustics
2024-03-05

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Study week 3			
Date	Activity	Teacher	Study materials
April 8 13:15-15:00	Lecture (Noise mapping software) – <i>Demonstration of a noise mapping software SoundPLAN</i> – <i>How to get started with using SoundPLAN in the project</i>	AG	Prepared by AG
April 8 15:15-17:00 (Computer room SB-D209)	Project Workshop , Group work with supervision – <i>Working with SoundPLAN (incl. creating building objects from sketches)</i> – <i>In room D209, the computers nr 19–24 have updated SoundPLAN installations</i>	FD, JF AG	
April 11 10:00–11:45 (Computer room SB-D209 booked 8–12)	Project Workshop , Group work with supervision – <i>Working with SoundPLAN, continued</i>	FD, JF AG	
April 12 15:15–17:00	Lecture (5) – <i>Noise annoyance and health.</i> – <i>Indoor noise levels. (Example of façade insulation.)</i> – <i>Outdoor sound propagation: Ground effect, Diffraction</i>	JF	Prepared by JF

Project content (student working time: 8 h)

- Work on the project
- Update the Logbook
- View video **Tutorial** on *Calculation examples of outdoor sound propagation/road noise*

Study week 4			
Date	Activity	Teacher	Study materials
April 15 13:15-15:00	Lecture (6) – <i>Outdoor sound propagation: Diffraction and ground, Refraction, Atmospheric absorption, and Turbulence</i>	JF	Prepared by JF
April 15 15:15-17:00 (On Zoom)	Project Workshop , Group work with supervision – <i>Working on project and HIT1.</i>	FD, JF	
April 18 08:00-09:45	Lecture (Traffic) – <i>Traffic flow modelling / Road transport planning</i>	JW	Prepared by JW
April 18 10:00-11:45	Project Workshop , Group work with supervision	FD	
April 19 15:15-17:00	Lecture (Tyre-road) – <i>Source modelling: Tyre-road interaction</i>	WK	Prepared by WK

Project content (student working time: 8 h)

- Hand-in of Task 1, Wednesday 12:00.
- Including **alternative future developments** and additional constraints (e.g. closing Eklandagatan east of Gibraltargatan).
- Traffic noise modelling
- Update the Logbook and hand in (Friday 12:00)

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Study week 5			
Date	Activity	Teacher	Study materials
April 22 13:15-15:00	Lecture (Rail 1) <i>Sources of rail noise</i>	AP	Prepared by AP
April 25 09:00-09:45	Tutorial Students working with calculation examples, with supervision/consultation (1 h, FD)	FD	Posted exercise examples and old exams
April 25 10:00-11:45	Lecture (Rail 2) <i>Sources of rail noise, continued</i> <i>Presentation of Hand-In Task 2, HIT2</i>	AP	Prepared by AP

Project content (student working time: 8 h)

- Considering **alternative future development** in terms of a tram line along Gibraltargatan
- Update the Logbook
- Work on Hand-In Task, HIT2

Study week 6			
Date	Activity	Teacher	Study materials
April 29 13:15-15:00	Tutorial <i>Students working on Hand-In Task</i> –	AP	Prepared by AP
April 29 15:15-17:00	Lecture (Groundvib 1) – <i>Ground vibrations</i>	FD	Prepared by FD
May 2 08:00–09:45	Lecture/Tutorial (Groundvib 2) – <i>Ground vibrations, continued</i> – <i>Calculation examples</i> – <i>Presentation of Hand-In Task, HIT3</i>	FD	Prepared by FD
May 2 10:00–11:45	Project Workshop , Group work <i>Working on ground vibration modelling</i>	FD	Prepared by FD

Project content (student working time: 8 h)

- Choice of group focus
- Continued project work
- Update the Logbook
- Work on Hand-In Task, hand in HIT2

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Study week 7			
Date	Activity	Teacher	Study materials
May 6 13:15–14 (On Zoom)	Lecture (7) – <i>Advanced numerical methods for outdoor sound propagation calculations (PE, FFP, FD-TD)</i>	JF	Prepared by JF
14:15-15 (In lecture hall only.)	– <i>Guest lecture: Predicting underwater sound</i>	Julia Winroth (IVL)	Prepared by JW

Project content (student working time: 6 h)

- Continued project work
- Update the Logbook
- Conclude and upload the Hand-In Tasks

Study week 8			
Date	Activity	Teacher	Study materials
May 13 13:15-15:00 (On Zoom)	Project Workshop , Group work with supervision – <i>Group presentations of concept (informal – in breakout rooms)</i> – <i>Decision of group focus</i> <i>Working on project and Hand-In Tasks</i>	FD, JF	
May 16 10:00–11:45 (On Zoom)	Project Workshop , Group work with supervision <i>Working on project</i>	FD, JF	

Project content (student working time: 15 h)

- Iteration: concept - plan - modelling - check - revise

Study week 9			
Date	Activity	Teacher	Study materials
May 20 13:15-16:00 Lecture room or Zoom	Project – <i>Final presentation of project (15 minutes presentation, 5 minutes discussion)</i> <i>Format: Slide show presentation: Process, concept, design, modelling, result – and your focus topic</i>	JF, FD	
May 23 09:00-11:45 (Open door, Fati's office)	Consultation time	FD	

Project content (student working time: 15 h)

- Continued project work
- Hand-in of report and slide show: May 25, 17:00.

Exam week

Exam week			
Date	Activity	Teacher	Study materials
Tue 28/05-2024 am	Written examination		