

Course PM/syllabus for:

Urban acoustics, ACE195, 7.5 ECTS

Chalmers International Master Programme in Sound & Vibration (MPSOV)

Quarter 4: 2022

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:

Jens Forssén (JF), tel. 772 8604, email: jens.forssen@chalmers.se
Fateme Dashti (FD), tel. 772 1871, email: fatemeh.dashti@chalmers.se
Astrid Pieringer (AP), email: astrid.pieringer@chalmers.se
Wolfgang Kropp (WK), email: wolfgang.kropp@chalmers.se
Jiaming Wu (JW), email: jiaming.wu@chalmers.se
Andreas Gustafson (AG), email: andgusta@chalmers.se

Course assistant:

Fateme Dashti (FD), tel. 772 1871, email: fatemeh.dashti@chalmers.se

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 40, 60 and 80 % of the exam's maximum points. The project is also graded (3, 4 and 5). 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.

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 21 13:15-15:00 (On Zoom)	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 21 15:15-16:00 (On Zoom)	Lecture (2, Intro, contd) – Introduction to project	JF, FD	Prepared by JF
March 24 08:00-09:45 (On Zoom)	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 24 10:00-11:45 (On Zoom)	Project Workshop – Introduction to project, continued (JF) – Getting started with the project (FD)	JF, FD	Prepared by JF
March 25 15:15-17:00 (On Zoom)	Project Workshop , Group discussions with supervision – Preparation for site visit (FD)	FD, JF	Prepared by JF, FD

Project content (student working time: 8 h)

- Presentation of 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
 - Calculation task of the week (to be part of the final project report, within the group)

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Study week 2			
Date	Activity	Teacher	Study materials
March 28 13:15-15:00 (Upload videos with derivations)	Lecture (4) <ul style="list-style-type: none"> 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 	JF	Prepared by JF
March 28 15:15-17:00 Outdoors	Project Workshop <ul style="list-style-type: none"> Site visit and inventory 	FD	Prepared by JF, FD (questionnaire)
March 31 08:00-09:45	Lecture (5) <ul style="list-style-type: none"> Sources of road noise (continued) Equivalent and maximum levels. Noise annoyance and health. Indoor noise levels. (Example of façade insulation.) Outdoor sound propagation: Ground effect, Diffraction 	JF	Prepared by JF
March 31 10:00-11:45 IRL/Zoom	Project Workshop , Group work with supervision	FD, JF	
April 1 15:15-17:00 (On Zoom)	Project Workshop , Group work with supervision	FD, JF	

Project content (student working time: 8 h)

- Evaluation of the site
- Student work: Site visit/Questionnaire/Measure with sound level meter
- Work on the Logbook
- Calculation task of the week

Study week 3			
Date	Activity	Teacher	Study materials
April 4 13:15-15:00 (On Zoom)	Lecture (6) <ul style="list-style-type: none"> Outdoor sound propagation: Diffraction and ground, Refraction, Atmospheric absorption, and Turbulence 	JF	Prepared by JF
April 7 08:00-09:45 (On Zoom)	Tutorial Calculation examples of outdoor sound propagation/road noise	JF	Prepared by JF
April 7 10:00-11:45	Lecture (Tyre-road) <ul style="list-style-type: none"> Source modelling: Tyre-road interaction 	WK	Prepared by WK
April 8 15:15-17:00	Project Workshop , Group work with supervision	FD, JF	Prepared by FD

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.)
- Work on the Logbook
- Calculation task of the week

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- EASTER BREAK -

Study week 4			
Date	Activity	Teacher	Study materials
April 21 08:00-09:45 (Zoom)	Lecture (Traffic) <i>Traffic flow modelling / Road transport planning</i>	JW	Prepared by JW
April 21 10:00-11:45 (Zoom)	Project Workshop , Group work with supervision	FD, JF and JW (first hour)	
April 22 15:15-17:00 (TA Lecture room)	Tutorial/Consultation/räknestuga About the Project calculations (showing Matlab_files_for_facade_reflection_and_barrier_diffraction) (1 h, JF) Students working with calculation examples, with supervision/consultation (1 h, FD)	JF FD	Posted exercise examples and old exams

Project content (student working time: 8 h)

- Including **alternative future developments** and additional constraints (e.g. closing Eklandagatan east of Gibraltargatan, ...).
- Traffic noise modelling
- Work on the Logbook

Study week 5			
Date	Activity	Teacher	Study materials
April 25 13:15-15:00	Lecture (Rail 1) <i>Sources of rail noise</i>	AP	Prepared by AP
April 28 09:00-09:45	Project Workshop , Group work with supervision	FD, JF	
April 28 10:00-11:45	Lecture (Rail 2) <i>Sources of rail noise, continued</i>	AP	Prepared by AP
April 29 15:15-17:00	Tutorial <i>Calculation examples of Rail noise</i>	AP	Prepared by AP

Project content (student working time: 8 h)

- Considering **alternative future development** in terms of a tram line along Gibraltargatan
- Work on the Logbook
- Calculation task of the week

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Study week 6			
Date	Activity	Teacher	Study materials
May 2 13:15-16:00	Lecture (V1) – Ground vibrations	FD	Prepared by FD
May 5 08:00-09:45	Lecture/Tutorial (V2) – Ground vibrations, continued – Calculation examples	FD	Prepared by FD
May 5 10:00-11:45	Project Workshop , Group work Working on ground vibration modelling	FD	Prepared by FD
May 6 15:15-17:00	Lecture – Demonstration of a noise mapping software SoundPLAN – How to get started with using SoundPLAN in the project	AG	Prepared by AG

Project content (student working time: 8 h)

- Choice of group focus
- Continued project work
- Work on the Logbook

Study week 7			
Date	Activity	Teacher	Study materials
May 9 13:15-16:00	Lecture – Demonstration of a noise mapping software SoundPLAN – How to get started with using SoundPLAN in the project	AG	Prepared by AG/JF
May 12 10:00-11:45 (On Zoom)	Lecture (7) – Advanced numerical methods for outdoor sound propagation calculations (PE, FFP, FD-TD)	JF	Prepared by JF
May 13 15:15-17:00 (Computer room SB-D209 booked)	Project Workshop , Group work with supervision – Working with SoundPLAN (incl. creating building objects from sketches)	FD AG	

Project content (student working time: 6 h)

- Continued project work
- Work on the Logbook

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Study week 8			
Date	Activity	Teacher	Study materials
May 16 13:15-15:00 (Computer room SB-D209 booked 13–17.)	Project Workshop , Group work with supervision <i>Working with SoundPLAN</i>	FD, AG	
May 19 10:00-11:45	Project Workshop , Group work with supervision <i>Working on project</i>	JF, FD	
May 20 15:15-17:00	Consultation/räknestuga Students working with calculation examples, with supervision/consultation	FD	

Project content (student working time: 15 h)

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

Study week 9			
Date	Activity	Teacher	Study materials
May 23 13:15-15:00 Zoom	Project Workshop , Group work with supervision – <i>Working on project</i>	FD, JF	
May 25 09:00-11:45 Zoom	Project – <i>Final presentation of project (15 minutes presentation, 5 minutes discussion)</i> <i>Format: Slide show presentation: Process, concept, design, modelling, result</i>	JF, FD	

Project content (student working time: 15 h)

- Continued project work
- Hand-in of report May 27, 12:00. (Hand-in of slide show: May 25, 17:00.)

Exam week

Written examination: morning **May 31**.

Exam week			
Date	Activity	Teacher	Study materials
May 30 10–12	Consultation time	FD	