MWL The Marcus Wallenberg Laboratory
for Sound and Vibration Research

COURSE INFORMATION – INTRODUCTION TO NOISE CONTROL 2018

Code: SD2110

Credits: 3

Lecturer and examiner: Leif Kari 070-798 7974 leifkari@kth.se

Prerequisites: Undergraduate courses in mechanics and mathematics.

Outline: The course covers fundamentals of the science of sound and vibration. It is a reading course that is possible to study whenever during the academic year. The examination is an oral examination and at a date and time that is suitable for the student. The oral examination is not only a control of the student´s learning but is also a learning occasion for the student while enabling the student to also ask questions.

Contents:
Definition of sound – sound pressure and velocity. Upper, mean, mean square and root mean square values. Frequency, period, wave length, wave number, phase velocity. Plane, cylindrical and spherical waves.

Diffraction of waves – Huygen's Principle. Reflection of waves. D'Alembert Principle. Harmonic and periodic signals. Fourier series analysis. Frequency spectrum – audible frequency range, octave band, one-third octave band, upper and lower frequency limit, band-width, centre frequency. Frequency filter – low-pass, high-bass, band-pass and band-stop filters. Measures of sound – sound pressure, sound intensity and sound power levels. Addition of sound fields – correlated and uncorrelated sources. Addition of frequency components. Weighted frequency spectrum – A, B, C and D-filters.

Standing and travelling waves. Longitudinal and transversal waves in infinite solids. Wave equation and its solutions in fluids.

Objectives:
After the course, the participant shall be able to:

- Know basic acoustic definitions:
  - Define peak value of sound pressure.
  - Define mean value of sound pressure.
  - Define root mean square value of sound pressure.

- Comprehend basic wave types in fluids:
  - Explain the characteristics of plane waves.
  - Give an example of plane waves from the 'real world'.
  - Explain the characteristics of cylindrical waves.
  - Give an example of cylindrical waves from the 'real world'.
  - Explain the characteristics of spherical waves.
  - Give an example of spherical waves from the 'real world'.

- Comprehend basic wave types in infinite solids:
  - Explain the characteristics of longitudinal waves.
  - Give an example of longitudinal waves from the 'real world'.
  - Explain the characteristics of transversal waves.
  - Give an example of transversal waves from the 'real world'.

- Comprehend Huygen's Principle:
  - State the principle in his or her own words.
  - Identify an example of the principle.

- Comprehend D'Alembert Principle:
  - State the principle in his or her own words.
  - Identify an example of the principle.
  - Predicts an outcome based on the principle for harmonic waves.'

- Apply acoustical methods to new situations:
  - Predict the total A-weighted sound power level for the whole audible frequency range from known third-octave band levels.
  - Calculate the harmonic components of an arbitrary periodic signal.
  - Computes the resulting sound level of a broad band sound when passed through a frequency filter.

- Synthesize complex waves from simple waves:
  - Combines longitudinal and transversal waves to form bending waves.
  - Creates standing waves from travelling waves using reflections.
  - Combines longitudinal and transversal waves to form quasi-longitudinal waves.

- Comprehend the wave equation:
  - Derive the wave equation in fluids.
  - Determine the solution of wave equation in fluids.

Grading scale:
P, F

Examination:
TEN1 - Examination, 3.0 credits, Grading scale: P, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Other requirements for final grade:

Oral examination (TEN1; 3 university credits).

Evaluation: Summative oral course evaluation are to be used at the same occasion as the oral examination.

Literature: Sound and Vibration, Chapter 1 and 4, Bodén, H., Carlsson, U., Glav, R., Wallin, H.P., Åbom, M.

Questions: Leif Kari is available for answering questions arising before, during or after the course.

MOST WELCOME!