# SD1116 Design of Silent and Vibration-free Products 6.0 credits

## Konstruktion av tysta och vibrationsfria maskiner

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

## Establishment

Course syllabus for SD1116 valid from Autumn 2013

## Grading scale

A, B, C, D, E, FX, F

## Education cycle

First cycle

## Main field of study

Technology

## Specific prerequisites

Basic courses in mathematics, mechanics, solid mechanics and electrical engineering.

## Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

## Intended learning outcomes

The general aim of the course is to promote the development of quiet and vibration-free products and processes. The course participants should be provided knowledge sufficient to carry out a relevant analysis of the sound and vibration properties of a product. Further, the knowledge should be deep enough for the participant to be able to engage with an expert in a discussion concerning sound and vibration properties of a product. The knowledge should also be a good basis for possible further studies within the sound and the vibration field.

The course participants should be able to on completion of the course:

- Account for basic sound and vibration technical concepts. Account for how sound and vibration influences humans and materials. Describe at a general level how international standards and regulations on the field are structured.
- Know how various types of signals can be classified. Understand and interpret the time history of a signal and the frequency spectrum. Know to how the frequency spectrum of a signal can be determined from its time history. Use the frequency response functional concept to assess how changes in excitation and transmission path influence the signal for a given observation point.
- Account for the physical bases of both the acoustic wave equation and the wave equations in solid materials and the spread, transmission and reflection of the waves, and which limitations that apply within the linear acoustics.
- Explain the basic physical bases of statistical room acoustics. Apply calculation methods and experimental methods for the spread, transmission and combination of sound in rooms, enclosed spaces and cabins.
- Identify, describe and analyse the mechanisms that give origin to sound and vibrations in technical systems. Be able to establish an acoustic diagram for a product.
- Explain the basic mechanisms for vibration isolation. Apply different methods to dimension vibration isolation. Explain different methods to limit sound propagation in ductwork, analyse the need of and select and dimension sound dampeners for different applications.
- Understand, explain and apply the principles of how excitation forces influence generated noise.

## Course contents

**Theory**: Fundamental concepts and measuring techniques. Sound and the influence of vibrations on humans and materials. Regulations and standards. Linear models. Description in time - and the frequency plane. Sound propagation, reflection, transmission and standing waves. Room acoustics. Vibrations. Quasi-longitudinal waves. Bending waves in beams and plates, torsion waves in axles. Vibration isolation. Sound in channels. Sound dampeners. Sound emission characteristics. Technically important excitation mechanisms. Design of power program for quiet operation.

**Calculation exercises**: Under the teaching sessions, arithmetical problems are counted to highlight the theory application for the solution of technical issues.

**Home assignments**. Home assignments are distributed and are presented continuous during the course. The home assignments give possibility to inclusion on examination.

**Laboratory sessions**: 1. Measurement and analysis of vibrations. 2. Measurement and analysis of noise.

## Course literature

Wallin, H.P., Carlsson, U., Åbom, M., Bodén. H. och Glav, R: Ljud och vibrationer. Marcus Wallenberg Laboratoriet för Ljud- och Vibrationsforskning, Inst. för Farkostteknik, KTH, 2013.

and working material from the course web page.

## Examination

- LAB1 - Laboratory Exercises, 1.0 credits, grading scale: P, F
- TEN1 - Written Theory Examination, 3.0 credits, grading scale: A, B, C, D, E, FX, F
- TEN2 - Written Problem-solving Examination, 2.0 credits, grading scale: A, B, C, D, E, FX, 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

- LAB1 - Laboratory course, 1,0, betygsskala: P, F
- TENA - Written theory exam, 3,0, betygsskala: P, F
- TENB - Written problem exam, 2,0, betygsskala: P, F

## Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.