



*Course syllabus*

# Mätteknik Electrical Measurements

**ESSF10, 5 credits, G2 (First Cycle)**

**Valid for:** 2023/24

**Faculty:** Faculty of Engineering, LTH

**Decided by:** PLED BME

**Date of Decision:** 2023-04-13

## General Information

**Main field:** Technology.

**Compulsory for:** E2

**Elective for:** D4-hs

**Language of instruction:** The course will be given in Swedish

## Aim

Measurement technologies are increasingly being integrated into everyday products such as mobile phones which e.g. detects movement to rotate the screen and activity watches that measures heart rate and step count. Modern cars have lane keeping assistance that detects road markings, distance meters to vehicles in front to prevent collisions, reverse assistance that detects distance to obstacles behind, temperature sensors that measure engine temperature and road surface temperature. In light of the increased use of autonomous systems, e.g. self-driving cars and the development of drones with their own decision-making ability, all of which depend on measurements of physical quantities such as speed, direction, position or environmental variables such as temperature, wind speed or humidity in the roadway, understanding of and skills in measurement techniques are becoming increasingly vital.

Within the field of medical technology, the possibilities for diagnostics, including the possibility of conducting telemedicine or self-care, increase with the possibilities of measurement technology. Within the manufacturing industry, various industrial processes naturally require comprehensive and accurate measurement methods to monitor and regulate various manufacturing processes and material flows. Most sensors that measure physical and chemical quantities produce an electrical signal which in turn must be detected and interpreted.

The problem picture includes that there is often a certain measurement uncertainty whose magnitude must be assessed or that the signal has been exposed to various

interferences that must be restricted. The purpose of the course is to provide a basic understanding of, and the skills to use, the measurement technologies and its associated techniques that detect such electrical signals, as well as to provide understanding of and skills to assess measurement uncertainties and to restrict interference.

## Learning outcomes

### *Knowledge and understanding*

For a passing grade the student must

- Have knowledge in different measurement methods and how they are designed to measure voltage, current, impedance, time, frequency and frequency spectra.
- Have insight in limitations of measurements methods as well as influence of noise to avoid measurement errors.

### *Competences and skills*

For a passing grade the student must

- Be able to select a suitable measurement method and instrument for a given task and perform measurements.
- Demonstrate skills in performing measurements with electrical measuring equipment.
- Be able to communicate results from lab work in writing.
- Be able to sort out and acquire information from a comprehensive material, e.g. a text book or lab exercise material, with limited reading instructions.

### *Judgement and approach*

For a passing grade the student must

- Have realised the importance of critical examination of measurement results to minimise measurement errors and misinterpretations.

## Contents

Fundamental concepts like loading of the measurement objects, influence of noise, uncertainty in the results and calibration. Digital oscilloscopes, digital multimeter, measurement of impedance with bridge- and voltage/current-methods, measurement of time and frequency with universal counter, measurement of frequency spectra with spectrum- and FFT-analyser (FFT – Fast Fourier Transform). Design of measurement systems.

## Examination details

**Grading scale:** UG - (U,G) - (Fail, Pass)

**Assessment:** Continuous assessment in connection to the lab exercises. Compulsory parts to be passed: Lab exercises including short pre-tests, lab reports, examination of a lab report.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

## Admission

**Assumed prior knowledge:** ESS010, EITA35 or ETE115, EITF90 or ETIA01 Electronics or equivalent

**The number of participants is limited to:** No

**The course overlaps following course/s:** BMEF05, BMEF15, EEMF15

## Reading list

- Compendium in measurements (in Swedish) which is sold by the department.
- Lab compendium.

## Contact and other information

**Course coordinator:** Lars Wallman, [lars.wallman@bme.lth.se](mailto:lars.wallman@bme.lth.se)

**Course coordinator:** Johan Gran, [johan.gran@bme.lth.se](mailto:johan.gran@bme.lth.se)

**Course homepage:** <http://www.bme.lth.se/>

**Further information:** The first lecture should be seen as a mandatory call. Enrolled and registered students who do not have a valid absence will receive a cancellation of the course.