

# Electrical Measurement Systems

Programme course

4 credits

Elektriska mätsystem

TFEI71

Valid from: 2017 Spring semester

**Determined by**

Board of Studies for Electrical  
Engineering, Physics and Mathematics

**Date determined**

2017-01-25

## Main field of study

Electrical Engineering

## Course level

First cycle

## Advancement level

G1X

## Course offered for

- Engineering Electronics, B Sc in Engineering

## Entry requirements

Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

## Prerequisites

Be able to explain and solve problems in simple current circuits, with series and parallel connections by use of the jw-method together with Ohm's and Kirchhoff's laws, that is, basic knowledge of electronics, according to TSEII15. Be able to exemplify and decide simple functional relationships, that is, the basic knowledge in mathematical analysis of one variable, according to TAIU10.

## Intended learning outcomes

The course provides knowledge of methods for measurements of electrical and physical quantities using analogue and digital measurement devices, error sources and electrical interferences. The course also provides knowledge about signal conditioning of transducer outputs and acquisition of measurement data with computers. e.g. instrument communication using GPIB or USB and LabView. After the course the student should be able to:

- Describe principles of, and solve problems in connection with, measurements of voltage, current, impedance, and electrical power in discrete networks and simple networks with character of transmission lines.
- Explain principles of simple circuits with operational amplifiers.
- Explain the origins and reduction of electrical disturbances.
- describe the functions of data acquisition cards and computers for doing measurements.
- describe principles behind computer-instrument communication, e.g. GPIB
- Give examples on and solve problems with temperature transducers and transmitters.

## Course content

First part. Practical applications of methods and problems in connection with measurements of current, voltage, impedance, and power quantities. The principles of digital voltmeters and their qualities. Analogue and digital oscilloscopes. Measurement of pulses and pulse reflections in transmission lines. Frequency analysis. The qualities of operational amplifiers as tool for signal conditioning. Noise and noise reduction techniques.

Second part. Here, the computer is treated as an instrument for acquisition of measurement data and signal conditioning. A data acquisition card for computer-based measurement of signals from light and temperature transducers is constructed, tested, and connected to a computer. Measurement and control of temperature is performed in a LabView environment. Communication and data acquisition using external instruments controlled by the computer(SCPI, USB, GPIB). Transducer and signal conditioning circuits and circuits for transmission of measurement data are treated.

## Teaching and working methods

The course consists of lectures and laboratory experiments in measurement and transducer technologies.

## Examination

LAB1	Laboratory work	3 credits	U, G
UPG1	Continuous examination	1 credits	U, 3, 4, 5

The continuous examination tests the students ability to solve problems related to electrical measurement systems. The laboratory course trains the students ability to solve problems related to electrical measurement systems with applications for measurements of electrical quantities and some quantities important for the industry, e.g, temperature. The laboratory course also trains the ability to collect data from typical sensors using data acquisition cards and computers

## Grades

Four-grade scale, LiU, U, 3, 4, 5

## Department

Institutionen för fysik, kemi och biologi

## Director of Studies or equivalent

Magnus Boman

## Examiner

Per Sandström

## Course website and other links

<http://cms.ifm.liu.se/edu/coursescms/>

## Education components

Preliminary scheduled hours: 48 h

Recommended self-study hours: 59 h

## Course literature

### Additional literature

Other

## Common rules

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at [http://stydokument.liu.se/Regelsamling/Innehall/Utbildning\\_pa\\_grund-\\_och\\_avancerad\\_niva](http://stydokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva).