Measurement technology

Mätteknik
6 credits

Programme course

TFYI07

Valid from: 2024 Autumn semester

Determined by	**Main field of study**	
Board of Studies for Electrical Engineering, Physics and Mathematics	Applied Physics	
Date determined	**Course level**	**Progressive specialisation**
2023-08-31	First cycle	G2X
Revised by	**Disciplinary domain**	
	Technology	
Revision date	**Subject group**	
	Engineering Physics	
Offered first time	**Offered for the last time**	
Autumn semester 2023		
Department	**Replaced by**	
Institutionen för fysik, kemi och biologi		

Course offered for

- Bachelor of Science in Applied Physics

Prerequisites

Be able to explain and solve problems in simple current circuits, with series and parallel connections using the jw-method together with Ohm's and Kirchhoff´s laws, i.e., basic knowledge of electronics. Be able to exemplify and deduce simple functional relationships, i.e., basic knowledge in mathematical analysis of one variable.

Intended learning outcomes

The aim of the course is to give theoretical and practical knowledge about measurements of electrical and physical quantities.

After the course the student should be able to:

- perform measurements of voltage and current in discrete networks with multimeters and oscilloscopes
- perform frequency analysis of signals using an oscilloscope
- perform measurement using some common industrial sensors.
- Implement computer controlled measurement systems with data acquisition cards and external instruments
- explain common error sources when measuring and perform error estimations of the measurement result and also explain origin of- and methods to reduce electrical disturbances.
- explain the functional principles behind sensors, measurement instruments and measurement systems as well as be able to perform calculations to solve problems related to these.

Course content

The course is divided into three parts with the following content:

Part 1: Practical applications of methods and problems in connection with measurements of current and voltage. The principles behind digital voltmeters and their properties. Measurements with digital oscilloscopes and a walkthrough of common functions in oscilloscopes. Different types of oscilloscope triggering methods. Frequency analysis with oscilloscopes. Origins of- and methods to reduce electrical disturbances. Accuracy in measurements.

Part 2: The computer 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 in a LabView environment. Measurements with data acquisition cards (DAQ-card) and externa instruments controlled by the computer (SCPI, USB, GPIB and more).

Part 3: Measurements and position, speed and acceleration using inductive transducers (LVDT, LVT) and piezoelectric accelerometers. Measurement strain/force using strain gauges and a wheatstone bridges. Signal conditioning av transducer signals. Measurements will be performed both manually and by computer based by software written by the student. This will make it possible for the student to learn both the functional principles behind the sensors as well how the sensors are used in modern applications.

Teaching and working methods

The course consists of lecturers and laboratory experiments in measurement and sensor technologies.

Examination

UPG1	Continuous examination	1.5 credits	U, 3, 4, 5
LAB1	Laboratory work	4.5 credits	U, G

Grades

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

Other information

About teaching and examination language

The teaching language is presented in the Overview tab for each course. The examination language relates to the teaching language as follows:

- If teaching language is “Swedish”, the course as a whole could be given in Swedish, or partly in English. Examination language is Swedish, but parts of the examination can be in English.
- If teaching language is “English”, the course as a whole is taught in English. Examination language is English.
- If teaching language is “Swedish/English”, the course as a whole will be taught in English if students without prior knowledge of the Swedish language participate. Examination language is Swedish or English depending on teaching language.

Other

The course is conducted in such a way that there are equal opportunities with regard to sex, transgender identity or expression, ethnicity, religion or other belief, disability, sexual orientation and age.

The planning and implementation of a course should correspond to the course syllabus. The course evaluation should therefore be conducted with the course syllabus as a starting point.

The course is campus-based at the location specified for the course, unless otherwise stated under “Teaching and working methods”. Please note, in a campus-based course occasional remote sessions could be included.