Course syllabus

Sensorer
Sensors

BMEF15, 7,5 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: N3
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 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 of different measurement methods and there functions for measure voltage, current, impedance, time and frequency
- Have a comprehension of limitations of measurement methods to avoid errors in measurements
- Have basic knowledge about different sensors functions, characteristics and limitations for physical, chemical and biological measurements.

Competences and skills
For a passing grade the student must

- Be able to choose a suitable sensor design and instruments in a given measurement situation and and perform measurements.
- Demonstrate skills in performing measurements with electrical measuring equipment.
- Be able to communicate experimental results.
- Be able to search, sort out and acquire information from an extensive information material with limited reading instructions.

Judgement and approach
For a passing grade the student must

- Be able to critical judge the results to minimise the risk of errors in measurements and misreadings.

Contents

Fundamental concepts for electrical measurements. Digital oscilloscopes, impedance measurements with wheatstone bridge, 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.

Furthermore, the course considers the most common sensors and measurement methods for measurement of physical, chemical and bio-chemical measurement parameters in the field of process- and manufacturing industry as well as medicine and society. Also, the future use of micro and nano sensors is discussed.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: For grade 3 the following compulsory parts need to be passed: Lab exercises including short pre-tests and presentation of project. For higher grade a written exam is given.

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: EITF90 Electromagnetics and Electronics.
The number of participants is limited to: No
The course overlaps following course/s: EEMF15, ESSF10, BMEF05

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
Course coordinator: Johan Gran, 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.