UCLouvain

lelec2811
2020

Instrumentation and sensors

Due to the COVID-19 crisis, the information below is subject to change, in particular that concerning the teaching mode (presential, distance or in a comodal or hybrid format).

5 credits	30.0 h + 30.0 h	Q1

Teacher(s)	Bol David (coordinator) ;Francis Laurent ;
Language :	English
Place of the course	Louvain-la-Neuve
Main themes	Our world is more and more digital with the increasing presence of information and electronic systems in industry, transportation, health cares and everyday's life. Many of the digital applications in these fields require the automatic acquisition of quantities from the physical world. In this course, we study the instrumentation chain and the sensors capable to perform this acquisition of physical quantities to translate them into analog electrical signals and then digital data. In this course, we will present different types of sensors used for the transduction of several physical values, e.g., occupancy, mechanical, acoustic, optical, bio/chemical, ' and the associated electronic circuits for signal conditioning and data transmission. We will highlight the figures of merit of the instrumentation chain and all sources of errrors along it
Aims	With respect to the AA referring system defined for the Master in Electrical Engineering, the course contributes to the develoopment, mastery and assessment of the following skills : • AA1.1, AA1.2, AA1.3 • AA2.1, AA2.2 • AA3.1, AA3.3 • AA4.1, AA4.2, AA4.3, AA4.4 • AA5.3, AA5.4, AA5.5 **After this course, the student will be able to :** • Describe the operation principles of various classes of sensors • Select sensors for a given application • Size, realise and characterise a complete instrumentation chain • Understand and use datasheets • Present a written report of the results of group project - - - - *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Evaluation methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** • Group assignements on a project during the semester. • Individual written exam.
Teaching methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** The course combines lectures to introduce the key concepts with project-based learning with a group project and a few exercise sessions.
Content	In this course course, we study the key basic concepts in sensor systems and their associated instrumentation. • Sensor definition, classification and characterisation • Noise, non idealities and calibration in sensor systems • Principles of transduction ruling the conversion from primary physical signals to electrical signals. • Analog signal conditioning (sensor interface, instrumentation amplifier, filters, instrumentation bridges). • Principles and techniques of sensor data acquisition • Digital signal processing (denoising) and data processing (feature extraction, event detection, classification) in sensor systems. • Some frequent applications in the industrial field will be considered: measure of displacement, speed, force, acceleration, pressure, temperature, light, acoustic.
Inline resources	Moodle http://moodleucl.uclouvain.be/course/view.php?id=3733

Bibliography	Livre de référence disponible à la BST : J. Fraden, Handbook of Modern Sensors: Physics, Designs, and Applications. 4th ed. Springer, 2010. ISBN: 9781441964656.
Faculty or entity in charge	ELEC

Force majeure

Evaluation methods	The written exam can be organized on-line. In this case, the professors could organize an oral exam for students for whom they have doubts about the grade obtained.

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Aims
Master [120] in Physical Engineering	FYAP2M	5		🔍
Master [120] in Electrical Engineering	ELEC2M	5		🔍
Master [120] in Electro-mechanical Engineering	ELME2M	5		🔍
Master [120] in Biomedical Engineering	GBIO2M	5		🔍