Study Program: Physics

Type and level of studies: Bachelor studies

Course name: Physics of Sensors

Lecturer**: Marija Stojanović Krasić**

Status: Elective

ECTS: 7

Attendance prerequisites: Mechanics and Thermodynamics 1, 2; Electromagnetism 1, 2; Optics; Fundamentals of Electronics

Course aims

The aim of the course is to provide basic knowledge about the physical principles of sensor operation, with special emphasis on the possibilities of converting signals of different nature into electrical signals.

Course outcome

Introduction to the physical operating principles of different types of sensors of non-electric quantities and their limitations, which allows an optimal choice of sensors for a specific application in measurement and control systems.

Course content

Theoretical part

Principles of converting physical into electrical quantities. Definitions: sensor, converter, actuator. Basic characteristics, significance and applications. Classification. Force and stress sensors: measuring tapes (glued and free). Magnetostrictive sensors. Multicomponent force sensors: torque and torsional stress measurements. Displacement and level sensors: potentiometer, inductive, capacitive. Speed and acceleration sensors. Angular velocity measurement. Vibration measurement. Pressure sensors: Bourdon tube, membranes, measuring tapes, inductive, capacitive. Piezoelectric pressure sensors. Integrated semiconductor pressure sensors. High-pressure sensors. Sound sensors. Vacuum gauges. Fluid velocity and flow sensors: flow meters - turbine, volumetric, tapered tube, induction, vortex, ultrasonic. Rotameter. Pitot tube. Mass flowmeters. Temperature sensors: based on dimensional changes (bimetallic, capillary), based on electrical resistance change (RTD, NTC, PTC), semiconductor, PN connections. Thermocouples. Non-contact temperature measurement. Chemical sensors. Biochemical sensors. Moisture sensors. Fire sensors. Electronic nose. Light and electromagnetic radiation sensors. Magnetic induction sensors and their applications. Ionizing radiation sensors. Electronic circuits significant for processing electrical signals from sensors. Intelligent sensor systems. An overview of sensor fabrication technologies.

Practical part

Experimental exercises and a visit to an appropriate laboratory.

Literature

1. Д. Станковић: Физичко техничка мерења – сензори, Универзитет у Београду, Београд 1997.
2. Д. Станковић, А. Ђуришић: Физичко техничка мерења – Лабораторијски практикум, Београд 1996.
3. М. Поповић: Сензори и мерења, Виша електротехничка школа, Београд 2000.
4. I. R. Sinclair: Sensors and transducers, Newnes, Oxford 2001.
5. http://www.sensorsweb.com/

Number of active classes				Other classes
Lectures: 2	Practical classes: 2	Other forms of teaching:		

Teaching methods

Lectures (2 classes per week during the semester), laboratory exercises (2 classes per week) during the semester and a visit to an appropriate laboratory.

Assessment (maximum 100 points)

Course assignments	**points**	Final exam	**points**
Lectures	10	written exam	30
Practical classes	20	oral exam	40
Laboratory exercises		.....	
Total	**30**		*70*